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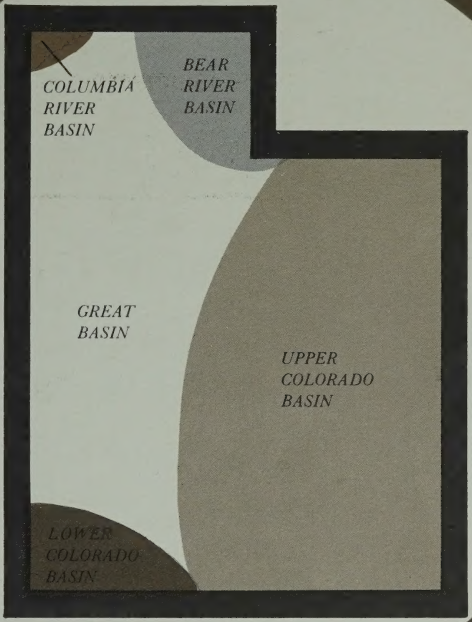

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DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1967

COOPERATIVE INVESTIGATIONS REPORT NO. 5

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DEVELOPING A STATE WATER PLAN

Ground-Water Conditions in Utah, Spring of 1967

by

C. H. Baker, Jr., Don Price, and others
United States Geological Survey

Prepared by the United States Geological Survey
in cooperation with the State of Utah

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INTRODUCTION

This report is the fourth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series are prepared cooperatively by the U. S. Geological Survey and the Utah Division of Water Resources and are designed to provide data for interested parties, such as legislators, administrators, and planners, to keep abreast of changing ground-water conditions.

This report, like the others (see references, p. 89), contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. It also contains supplementary data that are related to ground-water use in some areas. In reports of this series, the inclusion of such supplementary data as graphs showing chemical quality of water and maps showing water-table configuration is intended only for those years or areas where applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of the most important areas of ground-water withdrawal in the State for the calendar year 1966. Water-level fluctuations, however, are described for the period spring 1966 through spring 1967. Many of the data used in this report were collected by the Geological Survey in cooperation with the Utah State Engineer.

All reports on ground water in Utah that were released by the U.S. Geological Survey prior to 1967 are listed in a bibliography which is available as Utah State Engineer Information Bulletin No. 17. The following reports dealing with ground water in the State were released by the Geological Survey during 1966:

Ground-water conditions in Utah, spring of 1966, by J. W. Hood and others: Utah Water and Power Board Coop. Inv. Rept. 4.

Lake Bonneville: Geology and hydrology of the Weber Delta district, including Ogden, Utah, by J. H. Feth and others: U.S. Geol. Survey Prof. Paper 518.

Cause of fluctuations in the rate of discharge of Clear Lake Springs, Millard County, Utah, by R. W. Mower: U.S. Geol. Survey Water-Supply Paper 1839-E.

Ground-water resources of the Sevier River basin between Yuba Dam and Leamington Canyon, Utah, by L. J. Bjorklund and G. B. Robinson, Jr. (U.S. Geol. Survey Water-Supply Paper 1848, in press).

Ground-water hydrology of the Sevier Desert, Utah, by R. W. Mower and R. D. Feltis (U.S. Geol. Survey Water-Supply Paper 1954, in press).

Water from bedrock in the Colorado Plateau of Utah, by R. D. Feltis: Utah State Engineer Tech. Pub. 15.

Hydrologic and climatologic data collected through 1964, Salt Lake County, Utah, by W. V. Iorns, R. W. Mower, and C. A. Horr: U.S. Geol. Survey open-file rept. (duplicated as Utah Basic-Data Release 11).

Hydrologic and climatologic data collected through 1965, Salt Lake County, Utah, by W. V. Iorns, R. W. Mower, and C. A. Horr: U.S. Geol. Survey open-file rept. (duplicated as Utah Basic-Data Release 12).

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use, generally can be obtained only in specific areas. These areas of known or potential ground-water development are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality.

Less than 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows such as basalt, which contains interconnected vesicular openings or fractures; limestone, which contains openings enlarged by solution; and sandstone, which contains interconnected openings between the grains that form the rock. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State, in areas where water supplies cannot be readily obtained from unconsolidated rocks.

More than 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these sizes. Wells obtain the largest yields from the coarser materials that are sorted into deposits of equal grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains.

TABLE I.

Areas of known or potential ground-water development in Utah.

(locations are shown in fig. 1)

	Area	*Type of water-bearing rocks*
1.	Curlew Valley	Unconsolidated
2.	Park Valley	Do.
3.	Grouse Creek valley	Do.
4.	Hansel Valley	Do.
5.	Blue Creek valley	Unconsolidated
6.	Sink Valley	Do.
7.	Malad-Lower Bear River valley	Do.
8.	Valley east of the Pilot Range	Do.
9a.	East Shore area, Weber Delta and Bountiful districts	Do.
9b.	East Shore area, Brigham district	Do.
10.	Jordan Valley	Do.
11.	Cache Valley	Do.
12.	Bear Lake valley	Do.
13.	Upper Bear River valley	Do.
14.	Ogden Valley	Do.
15.	Morgan Valley	Do.
16.	Park City area	Do.
17.	Kamas Valley	Do.
18.	Heber Valley	Do.
19.	North flank Uinta Mountains	Do.
20.	South flank Uinta Mountains	Do.
21.	Uinta Basin	Do.
22.	Tooele Valley	Do.
23.	Skull Valley	Do.
24.	Dugway area	Do.
25.	Fish Springs Flat	Do.
26.	Sevier Desert	Do.
27.	Rush Valley	Do.
28.	Cedar Valley	Do.
29a.	Northern Utah Valley	Do.
29b.	Southern Utah Valley	Do.
30.	Juab Valley	Do.
31.	Sanpete Valley	Do.
32.	Central Sevier Valley	Do.
33.	Upper Sevier Valleys	Do.
34.	Deep Creek valley	Do.
35.	White Valley	Do.
36.	Snake Valley	Do.
37.	Pine Valley	Do.
38.	Wah Wah Valley	Do.
39.	Escalante Valley, Beryl-Enterprise district	Do.
40.	Escalante Valley, Milford district	Do.
41.	Beaver Valley	Do.
42.	Cedar City Valley	Do.
43.	Parowan Valley	Do.
44.	Upper Fremont Valley	Do.
45.	Lower Fremont Valley	Consolidated
46.	Spanish Valley	Unconsolidated
47.	Castle Valley (Grand County)	Do.
48.	Montezuma Creek area	Consolidated
49.	Kanab area	Unconsolidated
50.	St. George area	Do.
51.	Pavant Valley	Do.
52.	Colton area	Consolidated
53.	Scipio area	Do.
54.	Lisbon Valley	Do.
55.	Monticello area	Do.
56.	Blanding area	Do.
57.	Bluff area	Do.

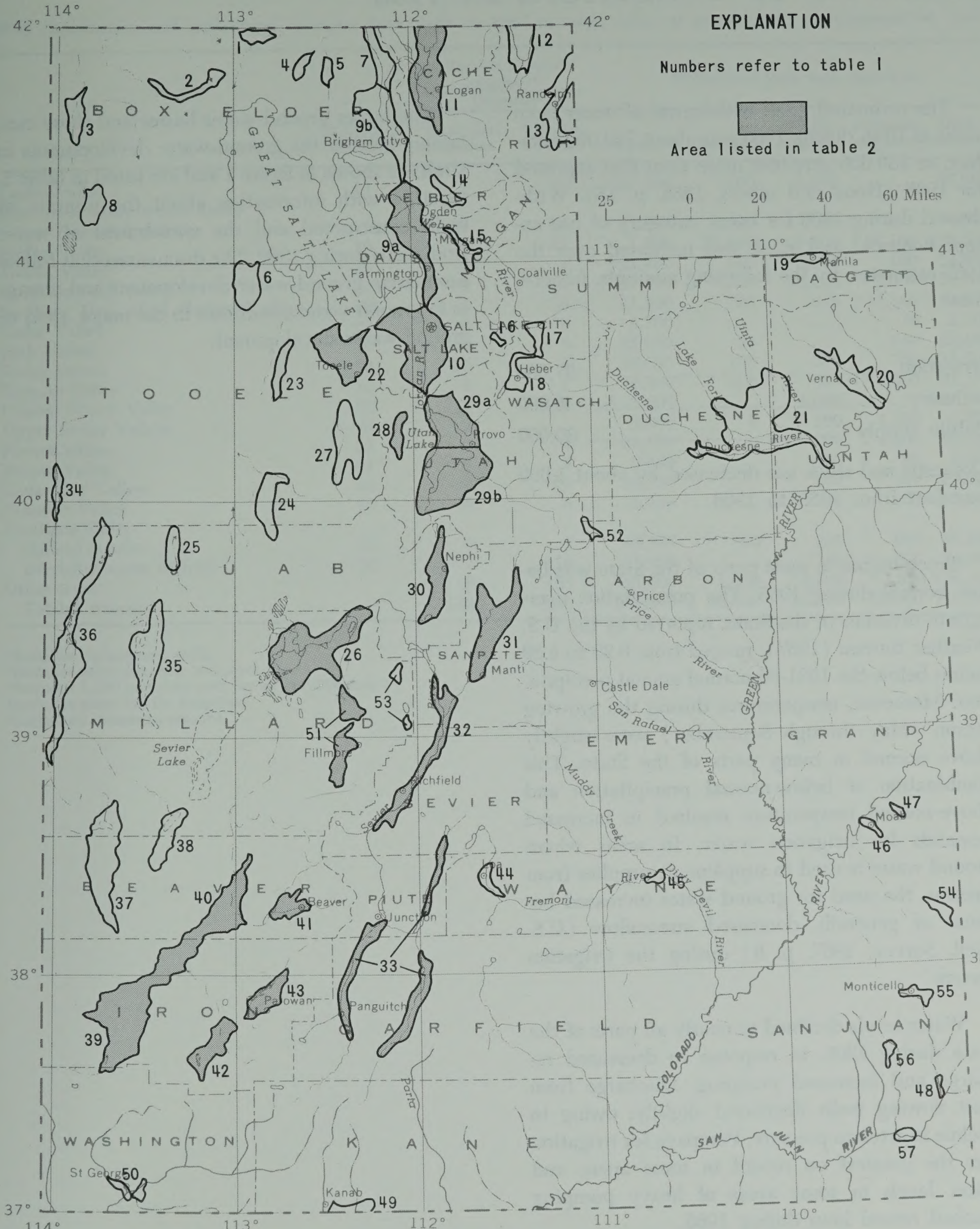


Figure 1.—Map of Utah showing areas of known or potential ground-water development.

SUMMARY OF CONDITIONS IN 1966

The estimated gross withdrawal of water from wells in Utah during 1966 was about 740,000 acre-feet, or 130,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 15). Withdrawal during 1966 for every category of use except domestic and stock was increased over the 1965 estimates, by the following amounts, in acre-feet:

Irrigation	97,000
Industry	6,000
Public supply	30,000

Domestic and stock use decreased by about 1,000 acre-feet from 1965 to 1966.

Precipitation in most parts of the State was below normal during 1966. The precipitation averages in divisions of the State, reported by the U.S. Weather Bureau (1967), ranged from 0.23 to 4.39 inches below the 1931-60 normal annual precipitation. Moreover, temperatures during the growing season (May through September) were slightly above normal in many parts of the State. This combination of below-normal precipitation and above-normal temperature resulted in increased demands for irrigation water. In areas where ground water is used to supplement supplies from streams, the need for ground water increased because of generally decreased streamflow (U.S. Geol. Survey, 1967, p. 8) during the irrigation season.

Water levels declined in nearly all parts of the State during 1966, in response to decreased recharge and increased pumping. Discharge from most flowing wells decreased slightly, owing to decline in artesian pressure. Pumpage for irrigation was the greatest on record in some areas, and water levels in some areas of heavy pumping reached record lows during 1966.

The larger ground-water basins and those containing most of the ground-water developments in Utah are shown in figure 1 and are listed in table 2, together with information about the number of wells constructed and the withdrawal of water from wells during 1966. The discussions that follow summarize ground-water development and changes in ground-water conditions in the major areas of ground-water development.

TABLE 2.

Well construction and withdrawal of water from wells in 1965 in major areas of ground-water development in Utah

		Number of wells completed[1]		Withdrawal from wells (acre feet)				
		Diameter						
Area	Number in figure 1	Less than 6 inches	6 inches or more	Irrigation	Industry	Public supply	Domestic and stock	Total (rounded)
Cache Valley	11	7	11	[2] 23,950	7,500	1,450	....	32,900
East Shore area, Weber Delta and Bountiful districts	9a	23	16	[2] 32,200	4,700	17,700	....	54,600
Jordan Valley	10	24	25	7,500	39,900	44,800	[3] 34,100	126,300
Tooele Valley	22	0	7	[2] 21,900	670	2,100	100	24,800
Northern Utah Valley	29a	9	15	37,000	7,200	82,200	[4] 2,500	54,900
Southern Utah anad Goshen Valleys	29b	6	10	31,100	726	919	[4] 10,240	42,900
Cedar Valley	28	0	0	2,700	....	....	10	2,700
Juab Valley	30	0	3	25,200	50	....	140	25,400
Sevier Desert	26	13	8	30,000	100	500	700	31,300
Sanpete Valley	31	4	1	16,800	400	400	[4] 3,500	21,100
Central Sevier Valley	32	8	2	[2] 15,200	....	1,000	....	16,200
Upper Sevier Valleys	33	2	....	2,000	3	190	1,120	3,300
Pavant Valley	51	0	4	88,000	....	200	300	88,500
Beaver Valley	41	0	5	5,640	....	100	60	5,800
Cedar City Valley	42	0	10	23,700	....	900	150	24,800
Parowan Valley	43	0	6	19,300	....	100	150	19,600
Escalante Valley								
Milford district	40	0	1	49,300	100	200	600	50,200
Beryl-Enterprise district	39	0	16	78,200	....	100	600	78,900
Other areas		6	123	[5] 27,500	[5] 1,000	[5] 6,600	[5] 1,000	[5] 36,100
Totals (rounded)		102	263	537,200	62,300	85,500	55,300	740,000

[1] Includes replacement wells.

[2] Includes some domestic and stock use.

[3] Includes 1,100 acre-feet used for air conditioning.

[4] Includes some use for irrigation.

[5] Estimated minimum amount.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CACHE VALLEY

by R. G. Butler

Cache Valley, as used here, refers to approximately 450 square miles of the valley that is in Utah. Ground water occurs in unconsolidated deposits in the valley, under both water-table and artesian conditions. The aquifers are recharged principally along the sides of the valley, and the ground water moves toward the center of the valley and thence toward a point of discharge from the valley near Cache Junction.

Eighteen new wells were constructed in Cache Valley during 1966. Seven of these wells were less than 6 inches in diameter, and 11 were 6 inches or more in diameter. Three wells were constructed for irrigation, and 15 for domestic and stock use and irrigation.

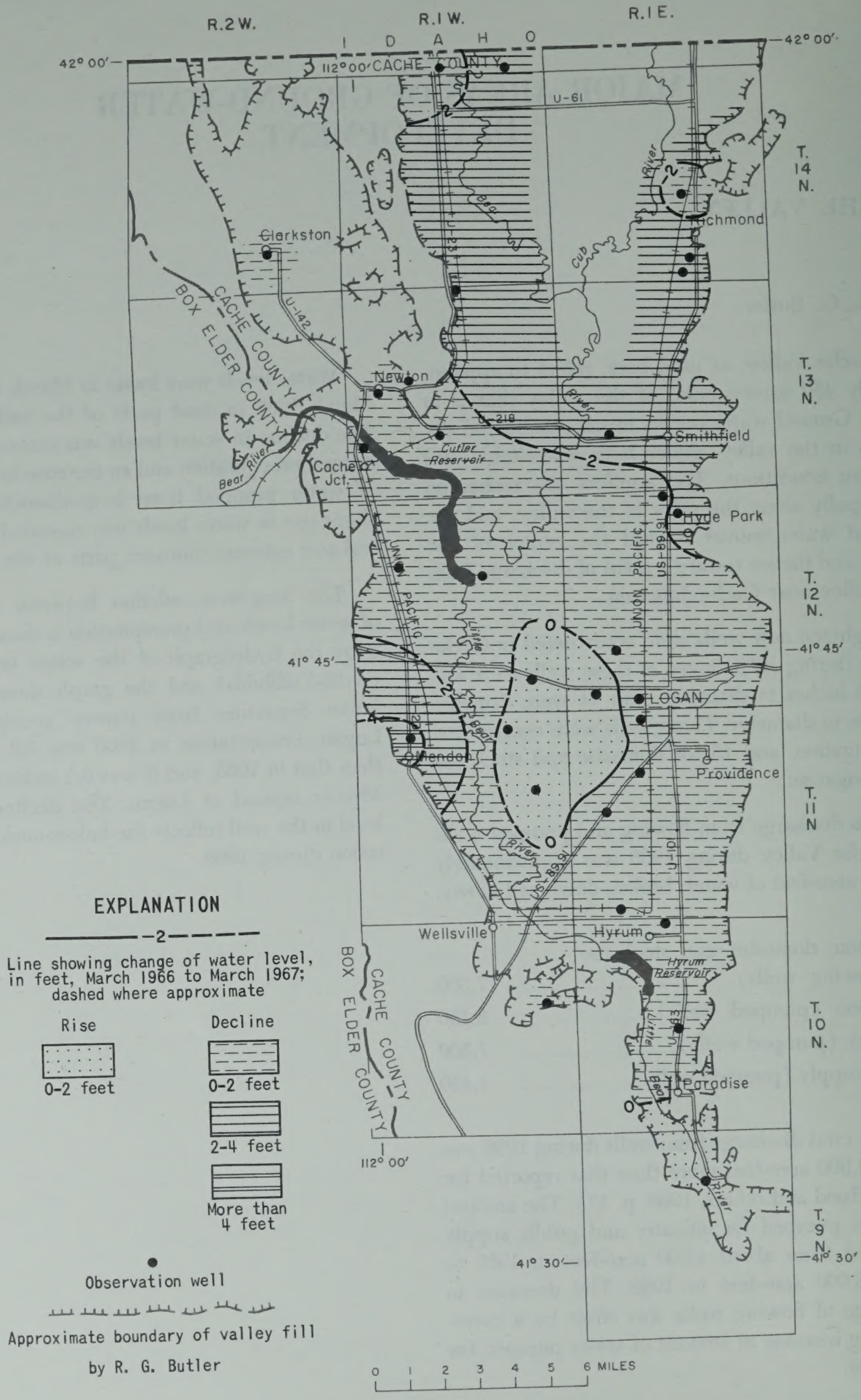
The discharge from flowing and pumped wells in Cache Valley during 1966 was approximately 32,900 acre-feet of water, broken down as follows:

Irrigation, domestic, and stock use (flowing wells)	17,500
Irrigation (pumped wells)	6,450
Industry (pumped wells)	7,500
Public supply (pumped wells)	1,450

The total discharge from wells during 1966 was about 4,900 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 17). The amount of water pumped for industry and public supply increased from about 4,300 acre-feet in 1965 to about 8,900 acre-feet in 1966. The decrease in discharge of flowing wells was offset by a corresponding increase in amount of water pumped for irrigation.

Water levels were lower in March 1967 than in March 1966 in most parts of the valley (fig. 2). The decline in water levels was caused by below-normal precipitation and an increase in the amount of water pumped from large-diameter wells. A slight rise in water levels was recorded in the central and extreme southern parts of the valley.

The long-term relation between fluctuations of water levels and precipitation is shown in figure 3 by the hydrograph of the water level in well (A-12-1)29bdd-1 and the graph showing cumulative departure from normal precipitation at Logan. Precipitation in 1966 was 9.2 inches less than that in 1965, and it was 6.1 inches below the 30-year normal at Logan. The decline in water level in the well reflects the below-normal precipitation during 1966.



by R. G. Butler

Figure 2.—Map of Cache Valley showing change of water levels from March 1966 to March 1967.

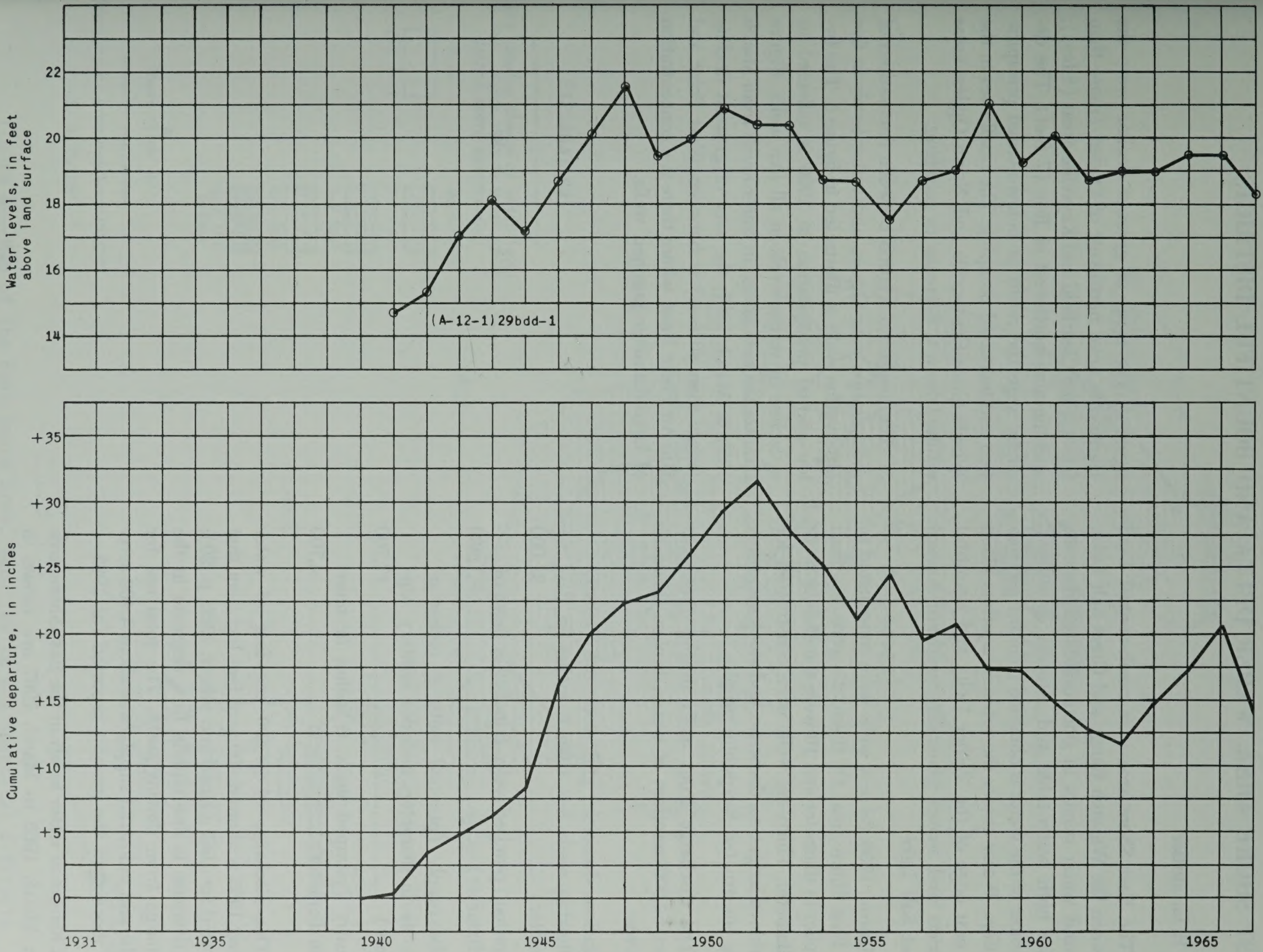


Figure 3.—Relation of water levels in well (A-12-1)29bdd-1 to cumulative departure from the 1931-60 normal annual precipitation at Logan Utah State University.

EAST SHORE AREA, WEBER DELTA AND BOUNTIFUL DISTRICTS

by R. G. Butler

The East Shore area is in north-central Utah between the Wasatch Range and Great Salt Lake. Ground water occurs in unconsolidated deposits under both water-table and artesian conditions, but most of the water is obtained from the artesian aquifers. Water enters the artesian aquifers along the east edge of the Weber Delta and Bountiful districts and moves generally westward toward Great Salt Lake.

During 1966, 39 new wells were constructed in the East Shore area. Of these, 23 were less than 6 inches in diameter and 16 were 6 inches or more in diameter. Thirty-six wells were constructed for combined irrigation, domestic, and stock use; three were constructed for public supply.

The discharge from wells during 1966 was about 54,600 acre-feet of water, broken down as follows:

Irrigation, domestic, and stock use (mostly flowing wells less than 6 inches in diameter)	31,000
Irrigation (pumped wells, 6 inches or more in diameter)	1,200
Public supply (pumped wells, 6 inches or more in diameter; includes military supply)	17,700
Industry (pumped wells, 6 inches or more in diameter)	4,700

The discharge of 54,600 acre-feet of water during 1966 is about 4,400 acre-feet less than that reported for 1965 (Hood and others, 1966, p. 20); the decrease is due chiefly to a decrease in the discharge from flowing wells. The total use for public and industrial supply was about 4,400 acre-feet more than the amount reported for 1965.

Changes in water levels in the East Shore area from March 1966 to March 1967 are shown in figure 4. The areas of greatest decline were the Harrisville area, northwest of Ogden (more than 9 feet); the Clearfield and Kaysville areas (8 feet); and the area northwest of Roy (7 feet). The declines were the result of below-normal precipitation and increased pumping. The small rises in the Woods Cross-Centerville and North Ogden areas resulted from a decrease in pumping.

The long-term relation between fluctuations of precipitation near Ogden and water levels in five observation wells is illustrated in figure 5. The below-normal precipitation in 1966 is reflected in a decline of water levels in all five wells. Figure 6 shows the net change in water levels from March 1953 to March 1967; the area of greatest decline (more than 40 feet) is between West Point and Hill Air Force Base, where there is a concentration of large-diameter pumped wells.

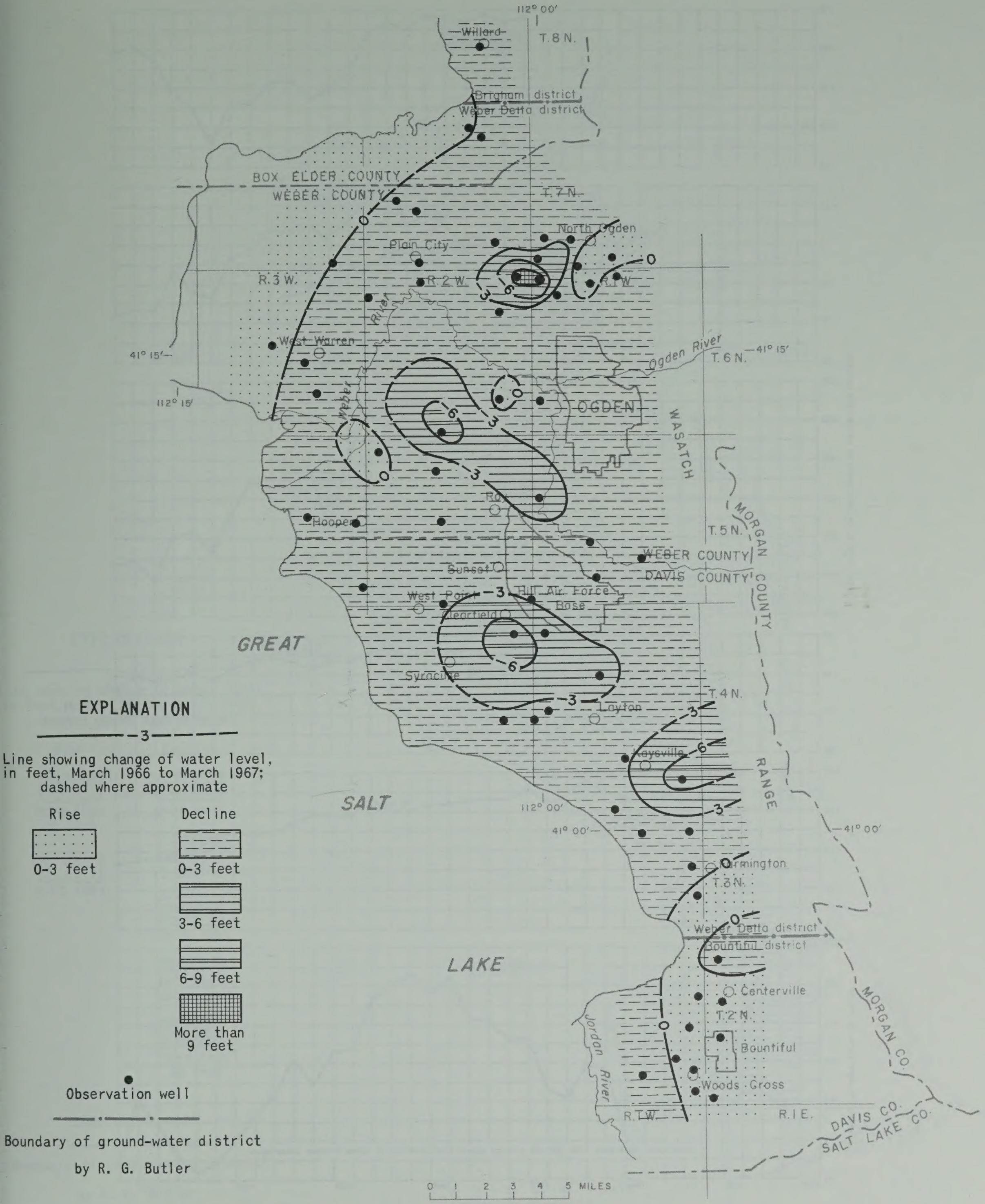


Figure 4.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1966 to March 1967.

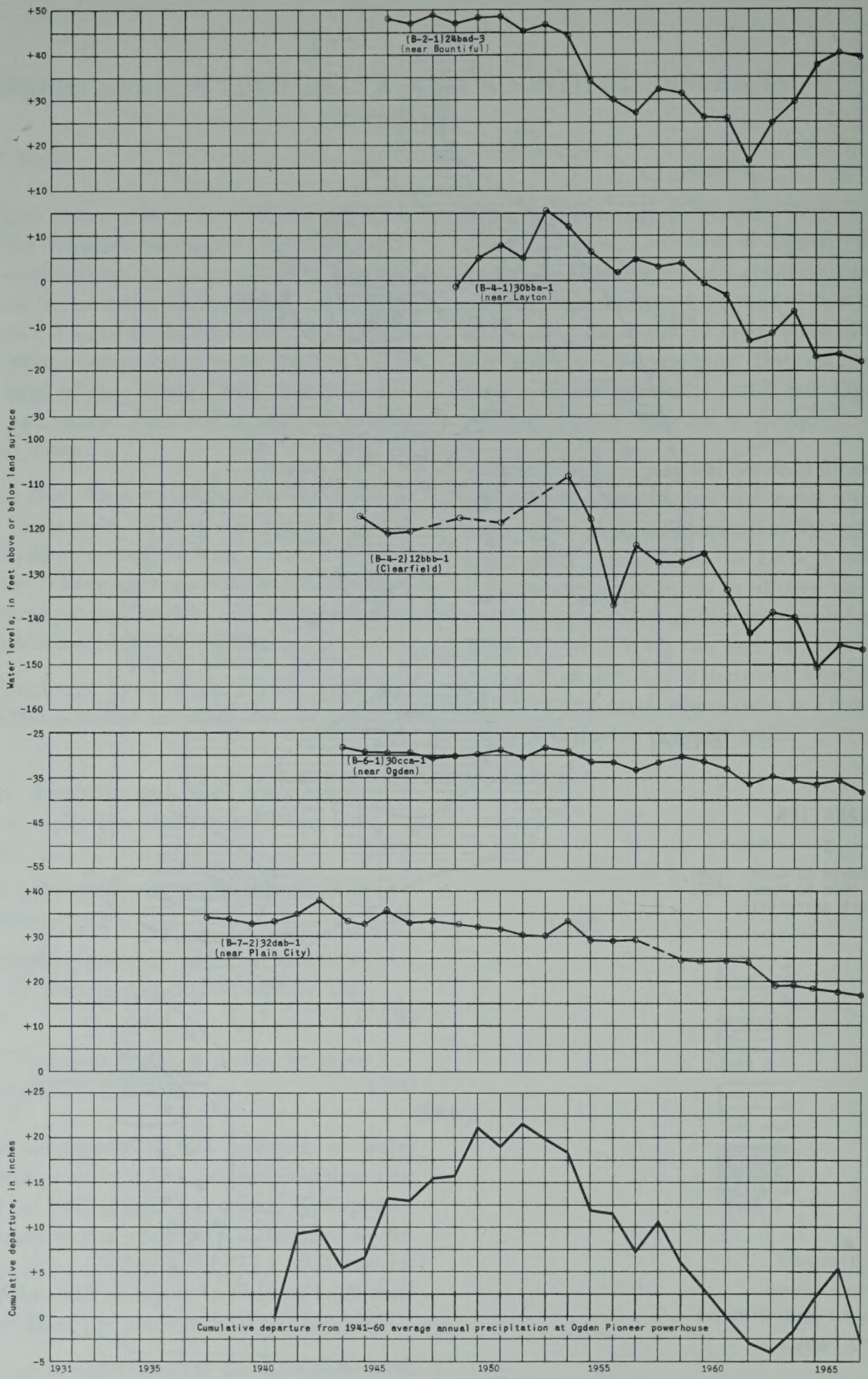


Figure 5.—Relation of water levels in wells near Bountiful, Layton, Clearfield, Ogden, and Plain City to cumulative departure from the average annual precipitation at Ogden.

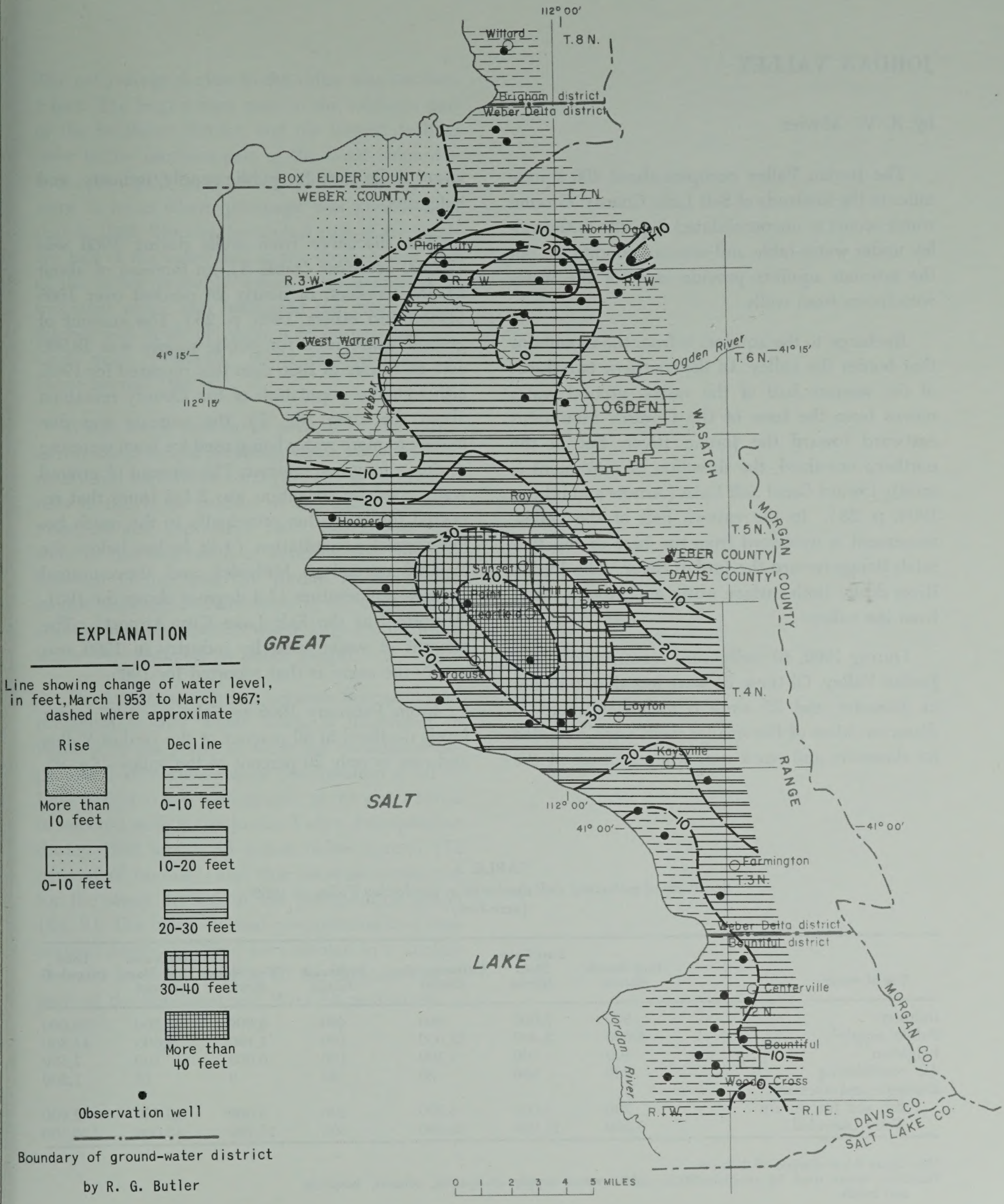


Figure 6.—Map of the East Shore area, Weber Delta and Bountiful districts, showing change of water levels from March 1953 to March 1967.

JORDAN VALLEY

by R. W. Mower

The Jordan Valley occupies about 400 square miles in the lowlands of Salt Lake County. Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions, but the artesian aquifers provide most of the water withdrawn from wells.

Recharge to the aquifers is from the mountains that border the valley. In the southern two-thirds of the western half of the valley, ground water moves from the base of the Oquirrh Mountains eastward toward the Jordan River; but in the northern one-third, the direction of movement is mostly toward Great Salt Lake (Arnow and others, 1964, p. 28). In the eastern half of the valley, movement is westward from the base of the Wasatch Range toward the Jordan River. The Jordan River drains both surface water and ground water from the valley.

During 1966, 49 wells were constructed in the Jordan Valley. Of these 24 were less than 6 inches in diameter and 25 were 6 inches or more in diameter. Most of the smaller wells were intended for domestic and stock use, whereas most of the larger wells were for public supply, industry, and irrigation.

The discharge from wells during 1966 was 126,300 acre-feet (table 3), an increase of about 24,000 acre-feet, or nearly 25 percent over 1965 (Hood and others, 1966, p. 25). The amount of ground water used for public supply was 19,900 acre-feet more in 1966 than that reported for 1965, although the population of the County remained about the same (fig. 7); the increase was due mainly to more water being used for lawn watering during a long hot summer. The amount of ground water used for irrigation was 2 1/2 times that reported for 1965, due principally to the much below-normal precipitation (4.48 inches below the 1931-60 normal at Midvale) and above-normal average temperature (1.4 degrees above the 1931-60 normal at the Salt Lake City Airport). The amount of water used by industry in 1966 was nearly the same as that reported for 1965.

From February 1966 to February 1967 water levels declined in 80 percent of the Jordan Valley and rose in only 20 percent of the valley (fig. 8).

TABLE 3.

Summary of estimated well discharge in the Jordan Valley in 1966[1]

(acre-feet)

Use of water	East Bench district	East Lake Plain district	Cottonwoods district	Southeast district	West Slope district	Northwest Lake Plain district	Total (rounded)
Industry	800	3,600	800	400	3,000	31,300	39,900
Public supply[2]	8,600	3,400	28,000	100	1,100	3,600	44,800
Irrigation	100	100	1,100	100	6,000	100	7,500
Air conditioning	200	900	20	20	0	10	1,200
Domestic and stock and fish and fur culture	200	9,000	8,500	200	5,000	10,000	32,900
Total (rounded)	9,900	17,000	38,400	800	15,100	45,000	126,300

[1] See figure 8 for location of districts.

[2] Includes water used by municipalities, public water supply companies, schools, hospitals, and hotels.

The net average decline in the valley was less than 1 foot. The largest rises were in the southern part of the Southeast district, and the largest declines were in the southern part of the West Slope district. As would be expected, the largest declines were in areas where pumpage was greater than that in 1965. Rises in the central part of the western half of the valley and in the southeastern part of the valley probably reflect large quantities of irrigation water that infiltrated the ground from ditches and fields or residual recharge from previous years (1963-65) when precipitation was above normal (fig. 9).

Water levels rose in 15 percent of the valley during the principal pumping season between Februrary and September 1966 (fig. 10) in contrast to rises in nearly 60 percent of the valley between February and September 1965. The largest rises were in the area north of Riverton and the area between Draper and the Jordan Narrows. The largest seasonal declines were in the East Bench and Cottonwood districts where large quantities of water were pumped for public supply.

The long-term relation between fluctuations of precipitation and water levels is illustrated in figure 9 by the graph showing the cumulative departure from normal annual precipitation at Silver Lake Brighton and hydrographs of the water levels in selected wells in the Jordan Valley. Precipitation during 1966 was 11.83 inches below normal (72 percent of normal), and this decrease accounted for the steep decline in the precipitation graph (fig. 9). The below-normal precipitation and consequent heavy pumping are reflected in a decline of water levels in wells in all the districts except parts of the Southeast and West Slope districts.

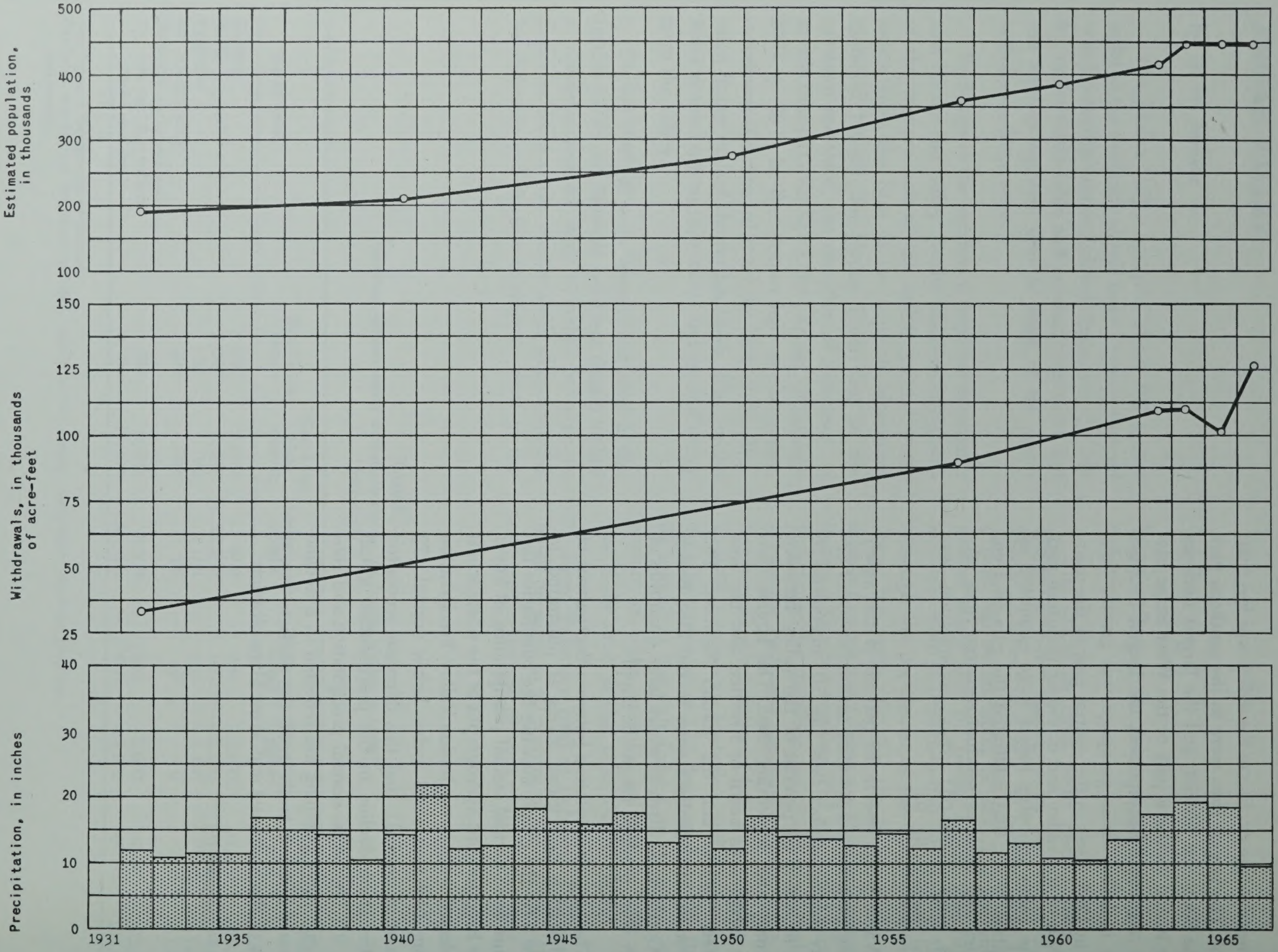


Figure 7.—Estimated population of Salt Lake County, water withdrawn through wells, and annual precipitation at Midvale for the period 1932-66.

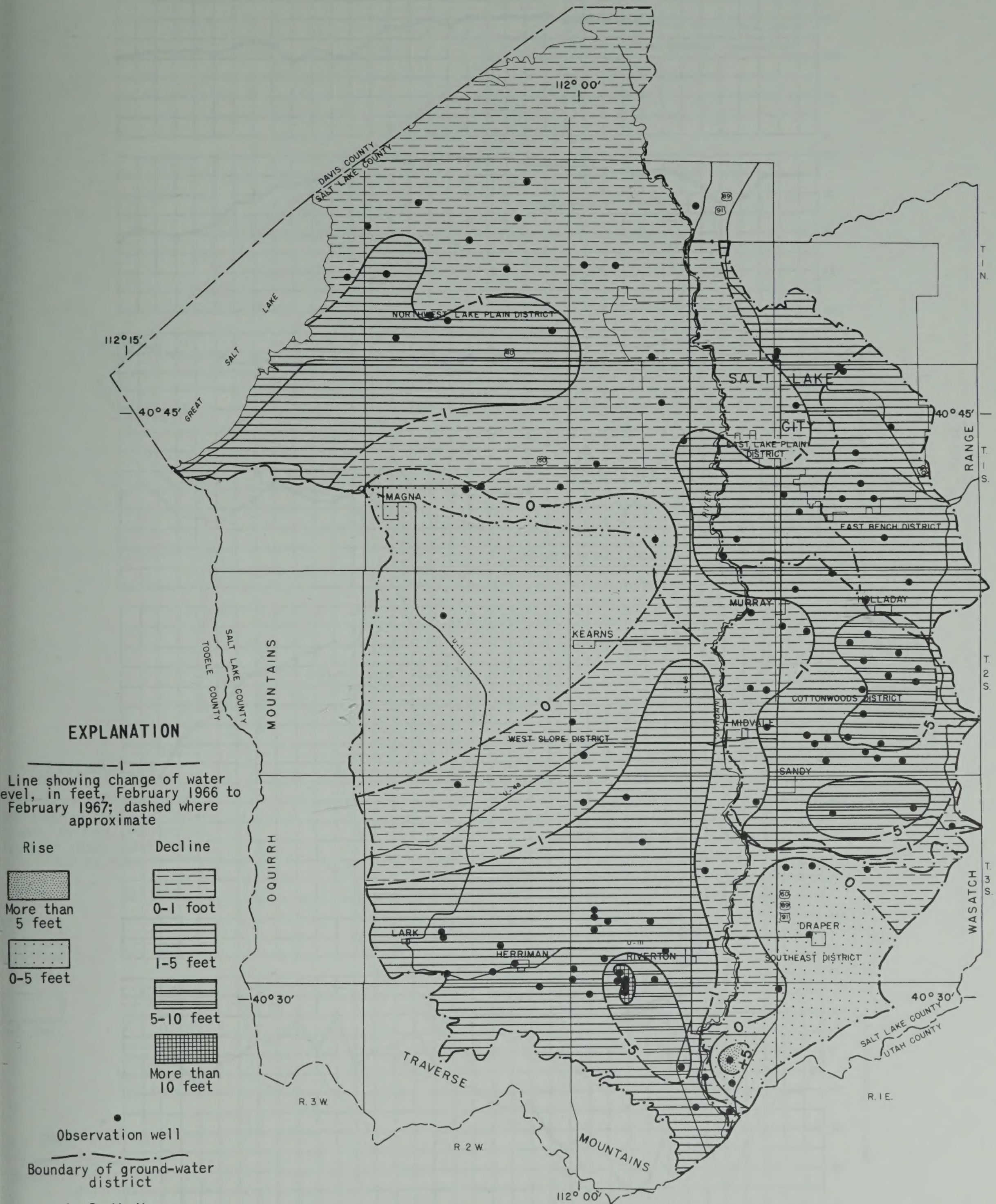


Figure 8.—Map of the Jordan Valley showing change of water levels from February 1966 to February 1967.

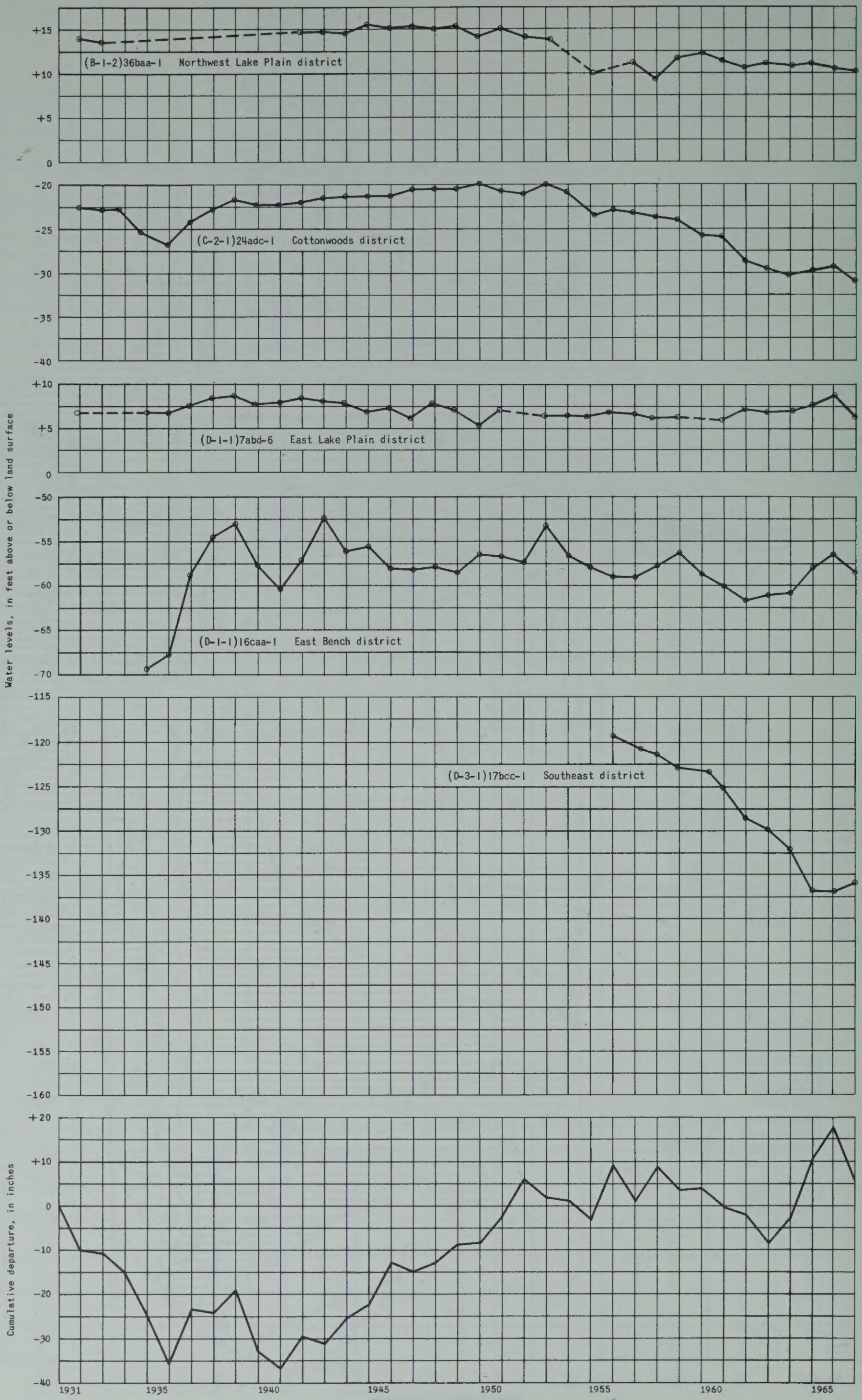


Figure 9.—Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the 1931-60 normal annual precipitation at Silver Lake Brighton.

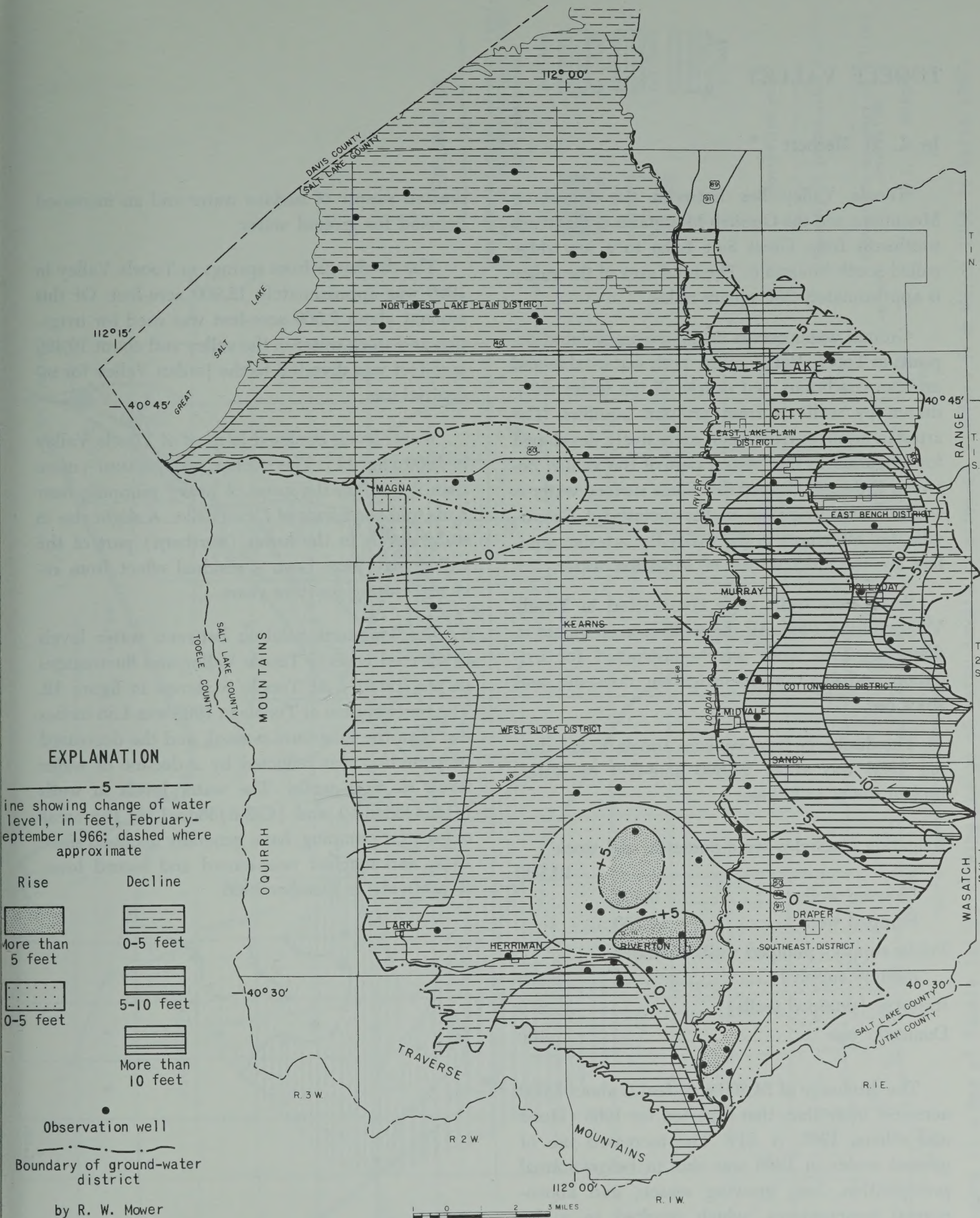


Figure 10.—Map of the Jordan Valley showing change of water levels from February to September 1966.

TOOELE VALLEY

by L. R. Herbert

Tooele Valley lies between the Stansbury Mountains and the Oquirrh Mountains and extends southwest from Great Salt Lake to a low ridge called South Mountain. The total area of the valley is approximately 250 square miles.

Ground water occurs in the unconsolidated deposits in Tooele Valley under both water-table and artesian conditions, but nearly all the water withdrawn by wells is from artesian aquifers. The artesian aquifers have been extensively developed for irrigation in the central part of the valley, between Erda and Grantsville. Some surface water is available for irrigation in the vicinity of Grantsville, but elsewhere in the valley the artesian aquifers are the chief source of irrigation water.

Seven new wells were constructed in Tooele Valley during 1966. All the wells were 6 inches in diameter. Two wells were constructed for irrigation, and five were for irrigation, domestic, and stock use.

The discharge from wells in Tooele Valley during 1966 was about 24,800 acre-feet of water, broken down as follows:

Irrigation (includes some domestic and stock use)		21,900
Flowing wells	9,200	
Pumped wells	12,700	
Public supply (pumped wells, includes military supply)		2,100
Industry (pumped wells)		670
Domestic use		100

The discharge of 24,800 acre-feet is about 5,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 31). The increased use of ground water in 1966 was due to below-normal precipitation, long growing season, and above-normal temperatures, which resulted in a decreased supply of surface water and an increased demand for ground water.

The discharge from springs in Tooele Valley in 1966 was approximately 12,900 acre-feet. Of this amount about 2,500 acre-feet was used for irrigation and stock water in the valley and about 10,400 acre-feet was diverted to the Jordan Valley for industrial use.

Water levels declined in most of Tooele Valley in 1966 (fig. 11). The decline was greatest (more than 2 feet) in the areas of heavy pumping near Erda and southwest of Grantsville. A slight rise in water levels in the lower (northern) part of the valley may have been a residual effect from recharge during previous years.

The long-term relation between water levels in selected wells in Tooele Valley and fluctuations of precipitation at Tooele is shown in figure 12. The precipitation at Tooele in 1966 was 4.86 inches less than the long-term normal, and the decreased precipitation was reflected by a decline of water levels in most wells. The water levels in wells (C-2-4)33add-1 and (C-2-6)36dcc1, in the areas of greatest pumping, have generally declined since 1949, and reached near-record and record lows, respectively, in October 1966.

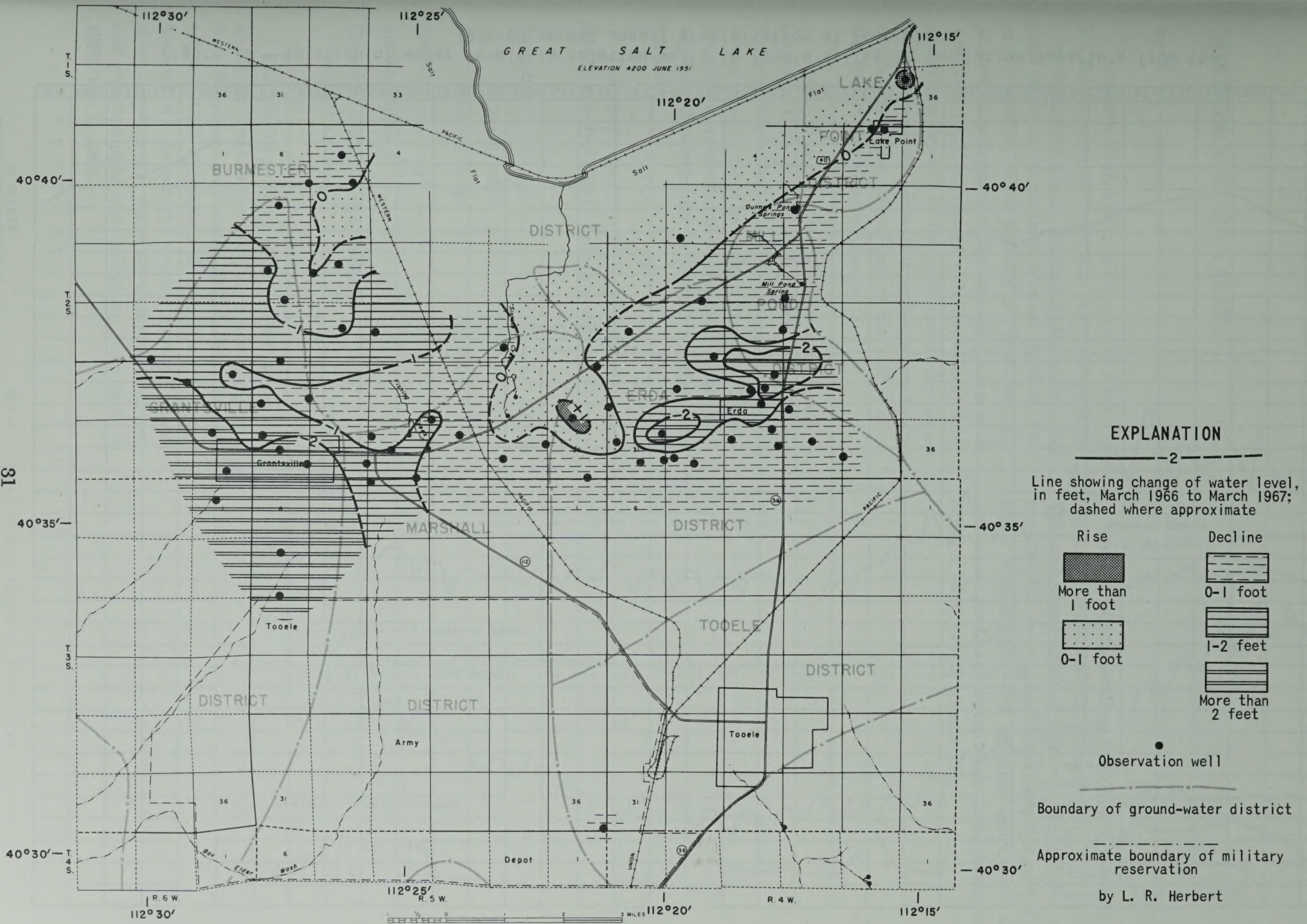


Figure 11.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1966 to March 1967.

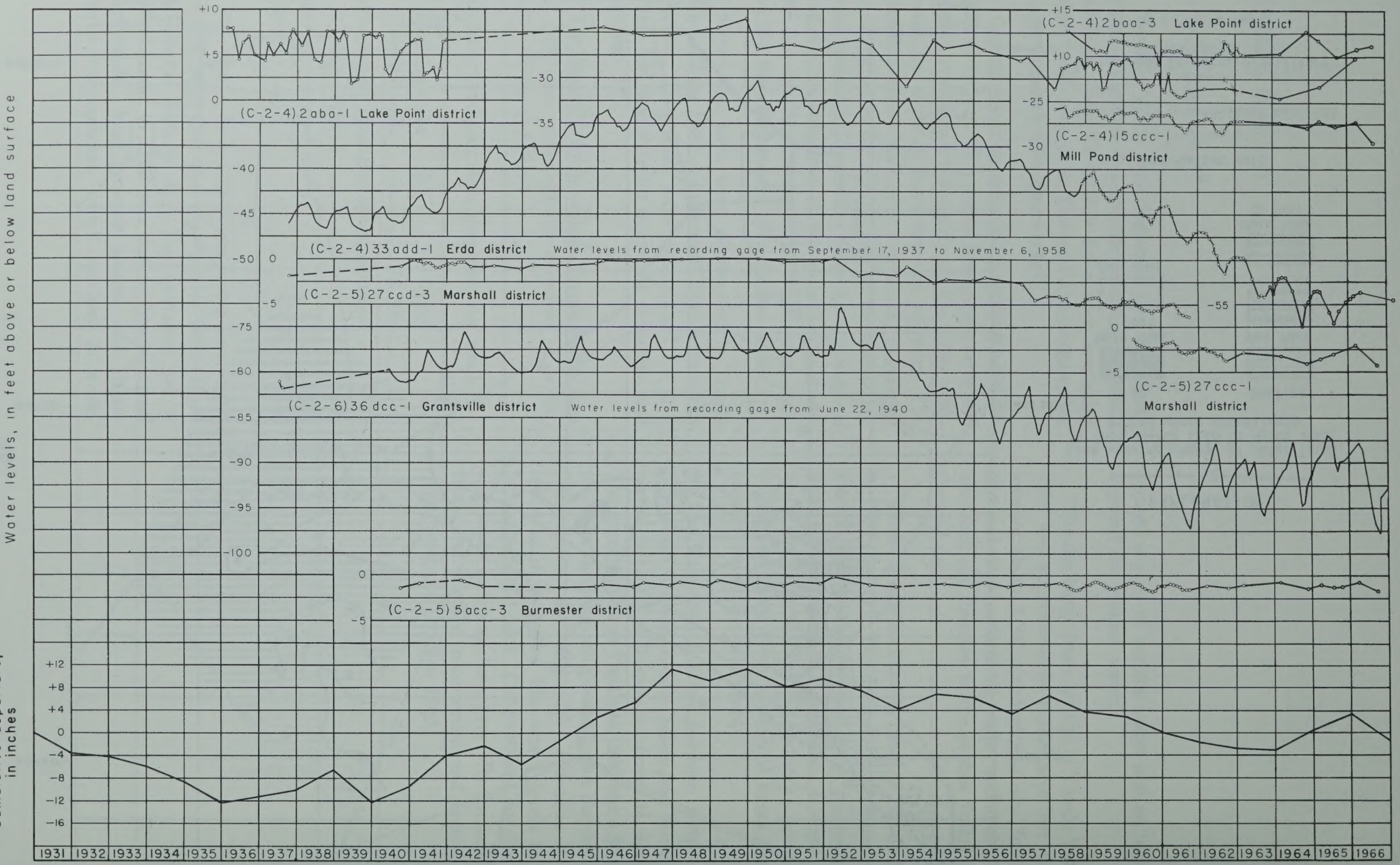


Figure 12.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the 1931-60 normal annual precipitation at Tooele.

NORTHERN UTAH VALLEY

by R. M. Cordova

Northern Utah Valley is the part of Utah Valley that is north of Provo Bay. Ground water occurs in unconsolidated deposits in the valley, and most wells discharge from artesian aquifers. Two of the aquifers are in deposits of Pleistocene age, and one is in deposits of Tertiary age. A few wells withdraw small amounts of water from water-table aquifers in deposits of the Lake Bonneville Group of Pleistocene age. The main recharge area for the aquifers is in the eastern part of the valley, along the foot of the Wasatch Range.

Twenty-four new wells were constructed in northern Utah Valley during 1966. Nine of the wells were less than 6 inches in diameter, and the others were 6 inches or more in diameter. Two of the wells were constructed for irrigation; the others were for domestic and stock use, including some irrigation.

The discharge from wells in 1966 was about 54,900 acre-feet, broken down as follows:

Irrigation		37,000
Flowing wells	25.000	
Pumped wells	12,000	
Industry		7,200
Public supply		8,200
Domestic and stock use (includes some irrigation)		2,500

The discharge from wells in 1966 was about 13,000 acre-feet more than the amount reported for 1965 (Hood and others, 1966, p. 34). Precipitation in 1966 was slightly above normal; however, because of a longer and warmer growing season, more supplemental water for industry, irrigation, and public supply was withdrawn from wells in 1966 than in 1965.

Water levels in northern Utah Valley generally respond to variations in precipitation (fig. 13). Although precipitation in 1966 was slightly above the 1931-60 normal, discharge from the groundwater reservoir exceeded recharge and caused a general net decline in water levels in the principal aquifers (figs. 14, 15, 16, and 17).

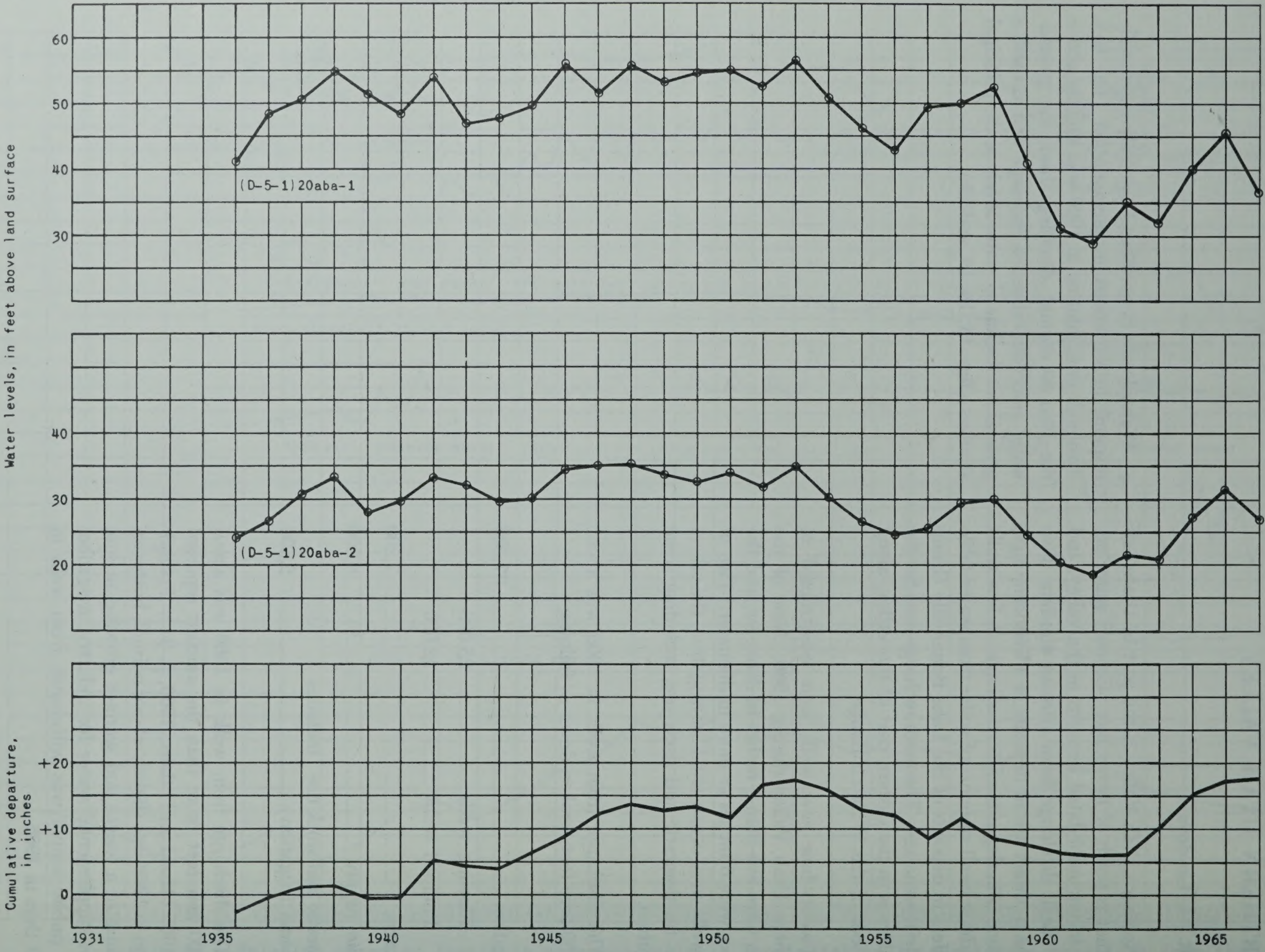


Figure 13.—Relation of water levels in wells (D-5-1)20aba-1 and (D-5-1)20aba-2 to cumulative departure from the 1931-60 normal annual precipitation at Utah Lake Lehi.

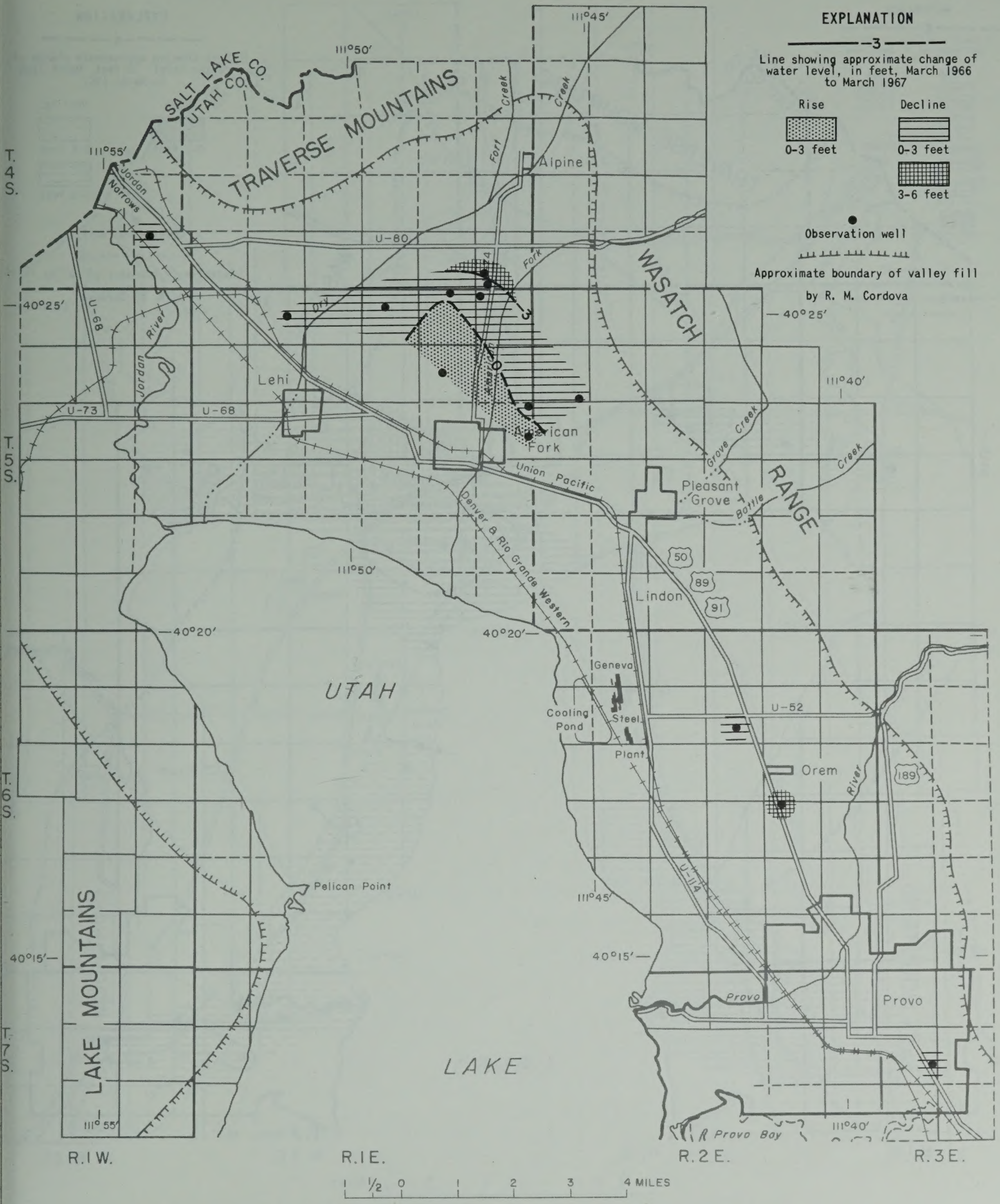


Figure 14.—Map of northern Utah Valley showing change of water levels in the water-table aquifer in the Lake Bonneville Group from March 1966 to March 1967.

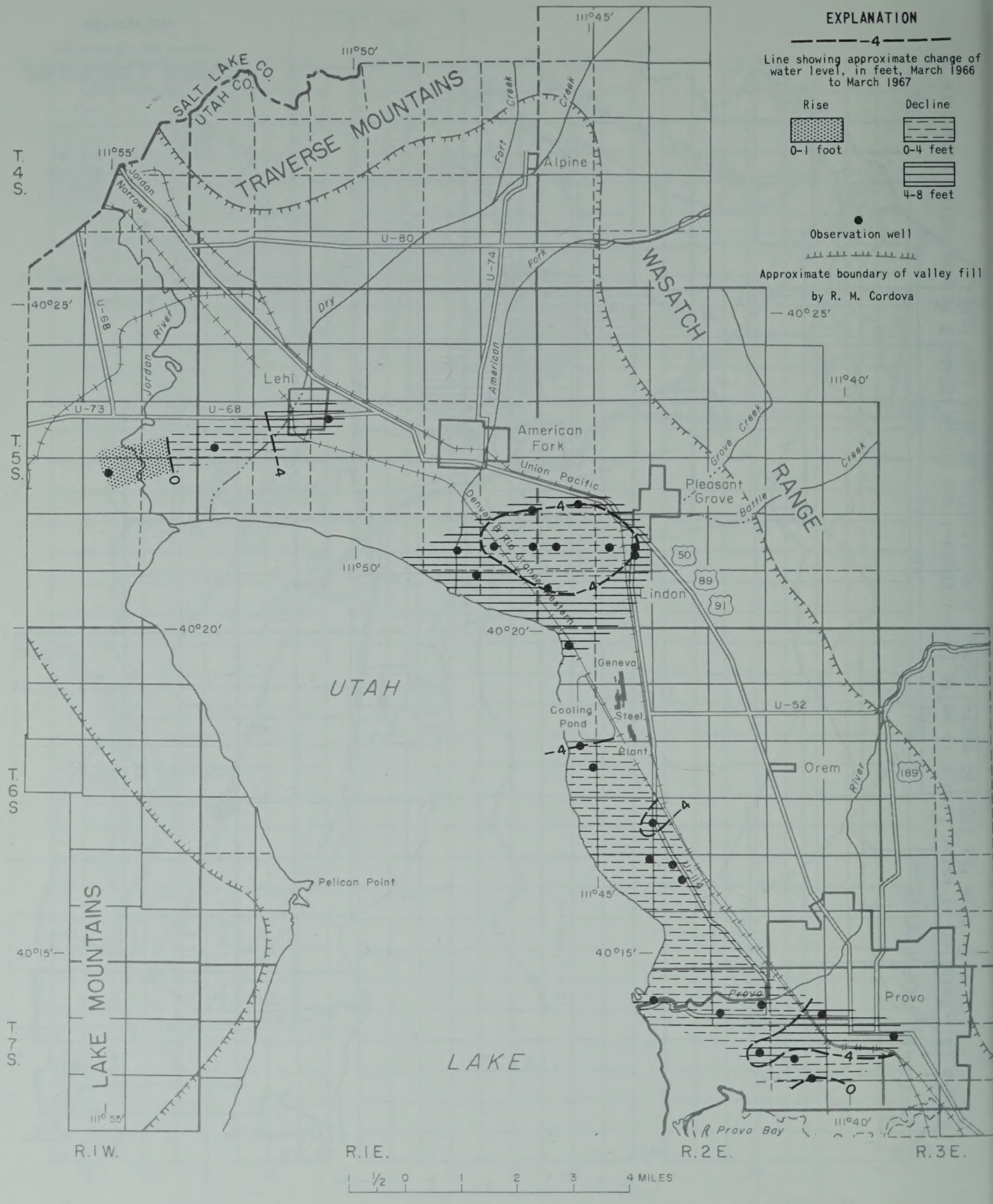


Figure 15.—Map of northern Utah Valley showing change of water levels in the shallow aquifer in rocks of Pleistocene age from March 1966 to March 1967.

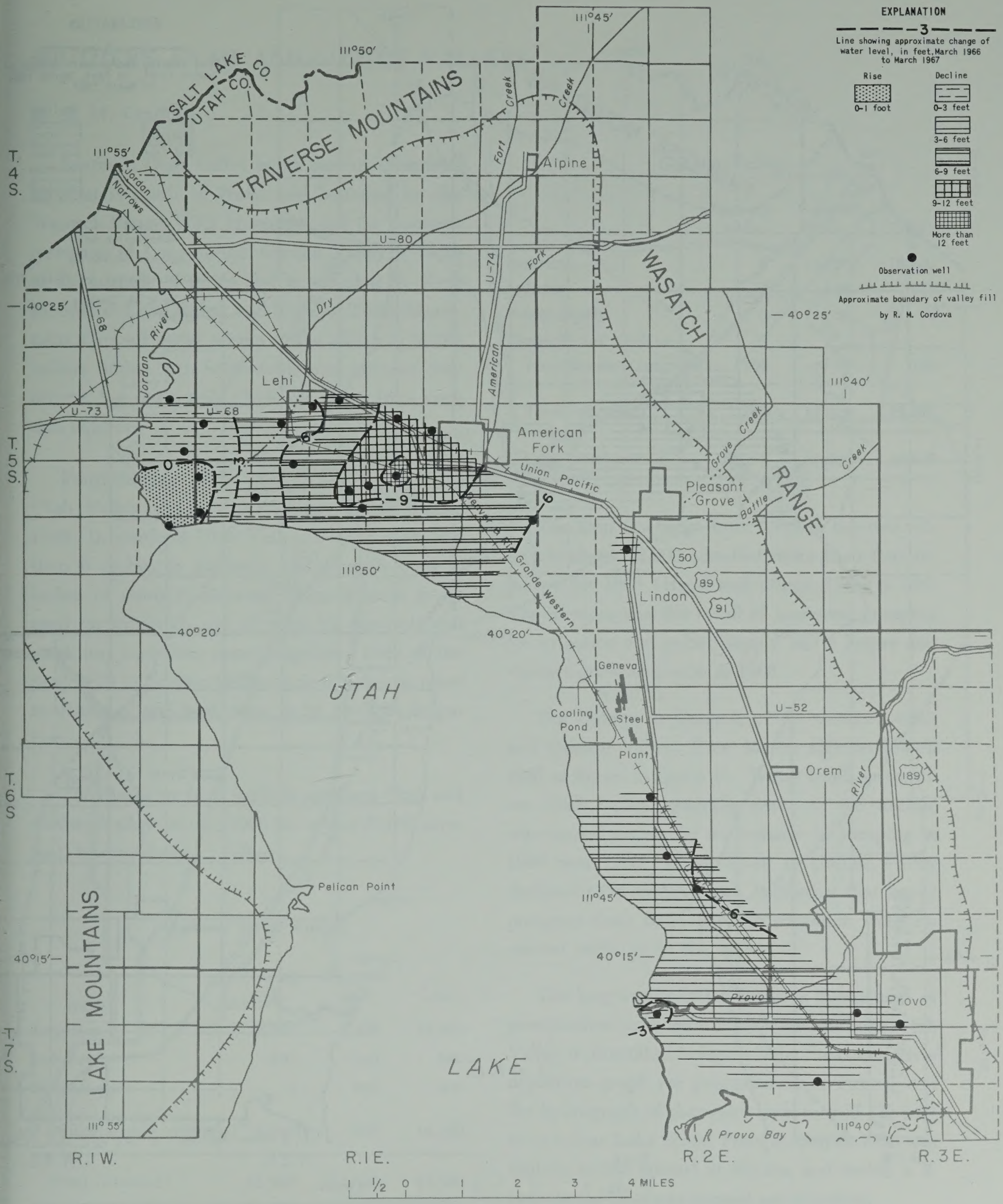


Figure 16.—Map of northern Utah Valley showing change of water levels in the deep aquifer in rocks of Pleistocene age from March 1966 to March 1967.

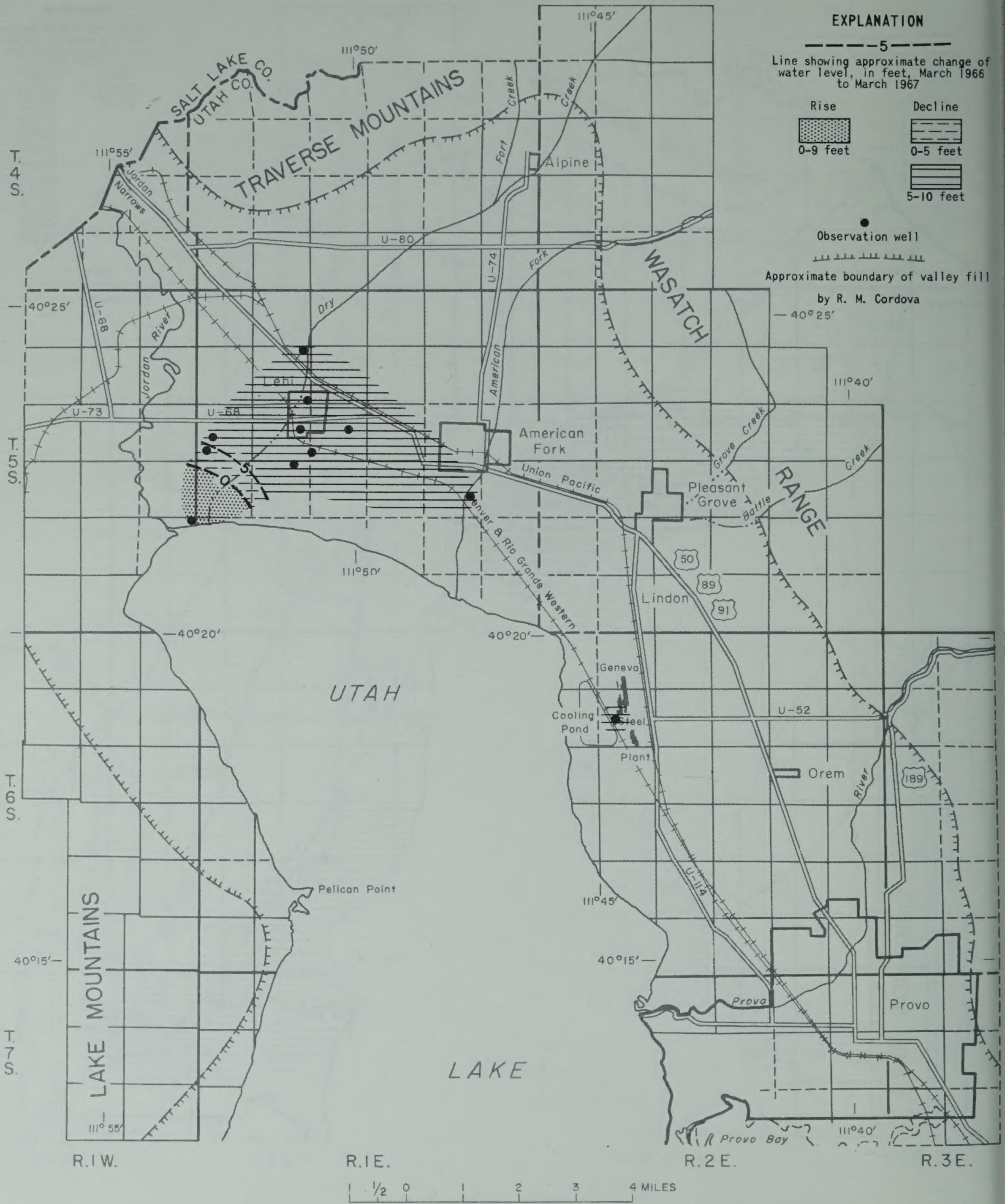


Figure 17.— Map of northern Utah Valley showing change of water levels in the aquifer in rocks of Tertiary age from March 1966 to March 1967.

SOUTHERN UTAH AND GOSHEN VALLEYS

by R. M. Cordova

Southern Utah Valley is the part of Utah Valley that is south of Provo and bounded by the Wasatch Range, West Mountain, and the northern extension of Long Ridge. Goshen Valley is south of the latitude of Provo and is bounded by West Mountain, Long Ridge, and the East Tintic Mountains. Ground water occurs in the alluvium in the valleys under both water-table and artesian conditions, but most wells discharge water from artesian aquifers.

Fourteen new wells were drilled in southern Utah Valley and two in Goshen Valley during 1966. In southern Utah Valley, 6 wells were less than 6 inches in diameter and 8 wells were 6 inches or more in diameter; 4 wells were to be used for irrigation and 10 were for domestic and stock use, including some irrigation. Both of the new wells in Goshen Valley were 6 inches or more in diameter, and both were to be used for irrigation.

The discharge from wells in southern Utah and Goshen Valleys during 1966 was about 43,000 acre-feet, broken down as follows:

Southern Utah Valley

	Flowing wells	Pumped wells	Total
Irrigation	2,900	9,400	12,300
Industry	400	140	540
Public supply	0	900	900
Domestic and stock use (includes some irrigation)	9,500	600	10,100
Total (rounded)	12,800	11,000	23,800

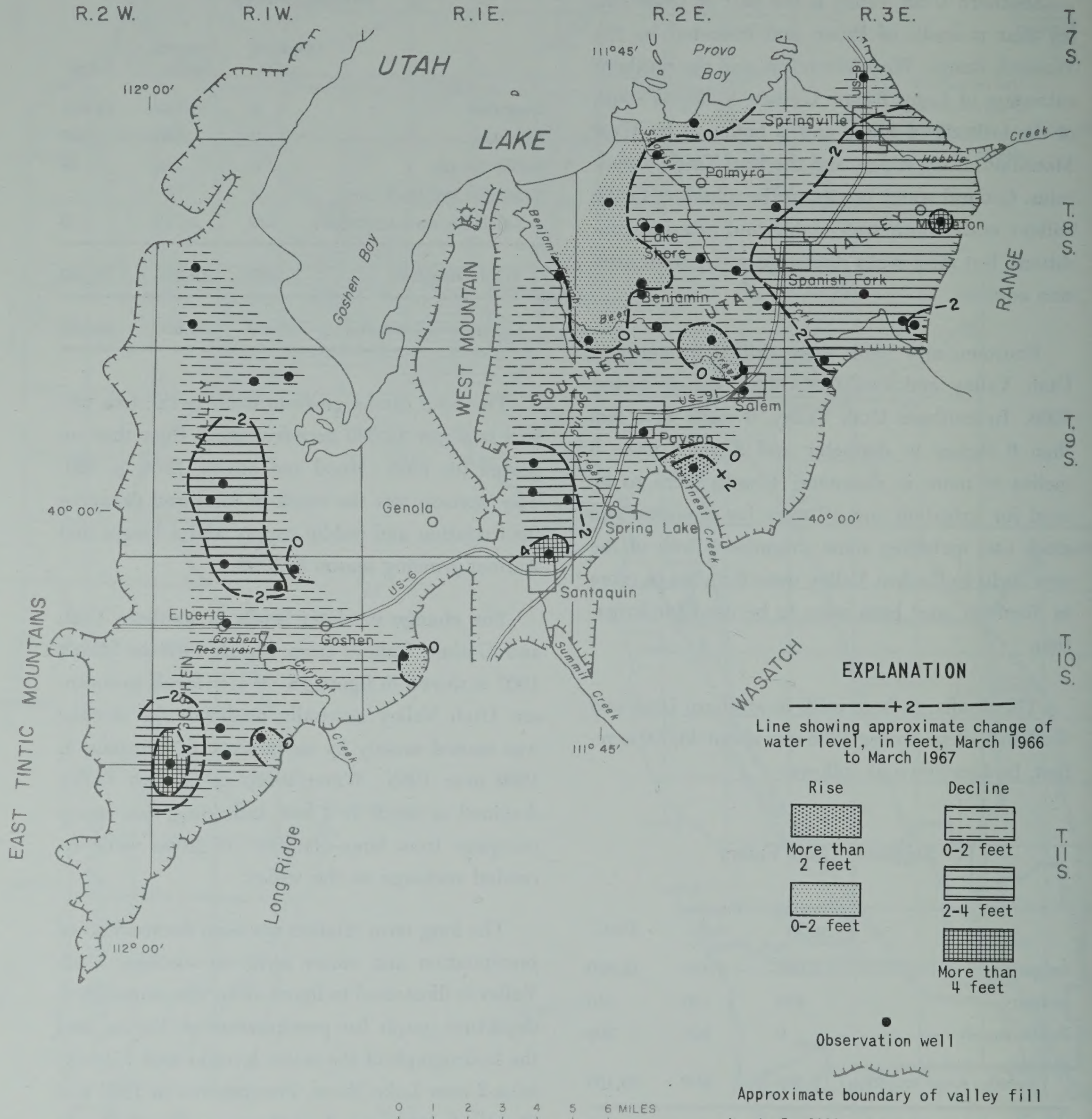
Goshen Valley

	Flowing wells	Pumped wells	Total
Irrigation	0	18,800	18,800
Industry	0	186	186
Public supply	0	19	19
Domestic and stock use (includes some irrigation)	100	40	140
Total (rounded)	100	19,000	19,100
Grand total (rounded)	12,900	30,000	42,900

The total discharge from wells in the two valleys is about 12,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 40). The increase was the result of increased pumping for irrigation and public supply and a longer and warmer growing season in 1966.

The change in water levels in southern Utah and Goshen Valleys from March 1966 to March 1967 is shown in figure 18. Water levels in southern Utah Valley generally declined; the decline was caused mainly by an increase in pumping in 1966 over 1965. Water levels in Goshen Valley declined as much as 4 feet, indicating that heavy pumpage from large-diameter irrigation wells exceeded recharge to the valley.

The long-term relation between fluctuations of precipitation and water levels in southern Utah Valley is illustrated in figure 19 by the cumulative-departure graph for precipitation at Payson and the hydrograph of the water level in well (D-8-2) 4cba-2 near Lake Shore. Precipitation in 1966 was slightly below normal at Payson and ended a 3-year period of above-normal precipitation.



by J. D. Gillespie and R. M. Cordova

Figure 18.—Map of southern Utah and Goshen Valleys showing change of water levels from March 1966 to March 1967.

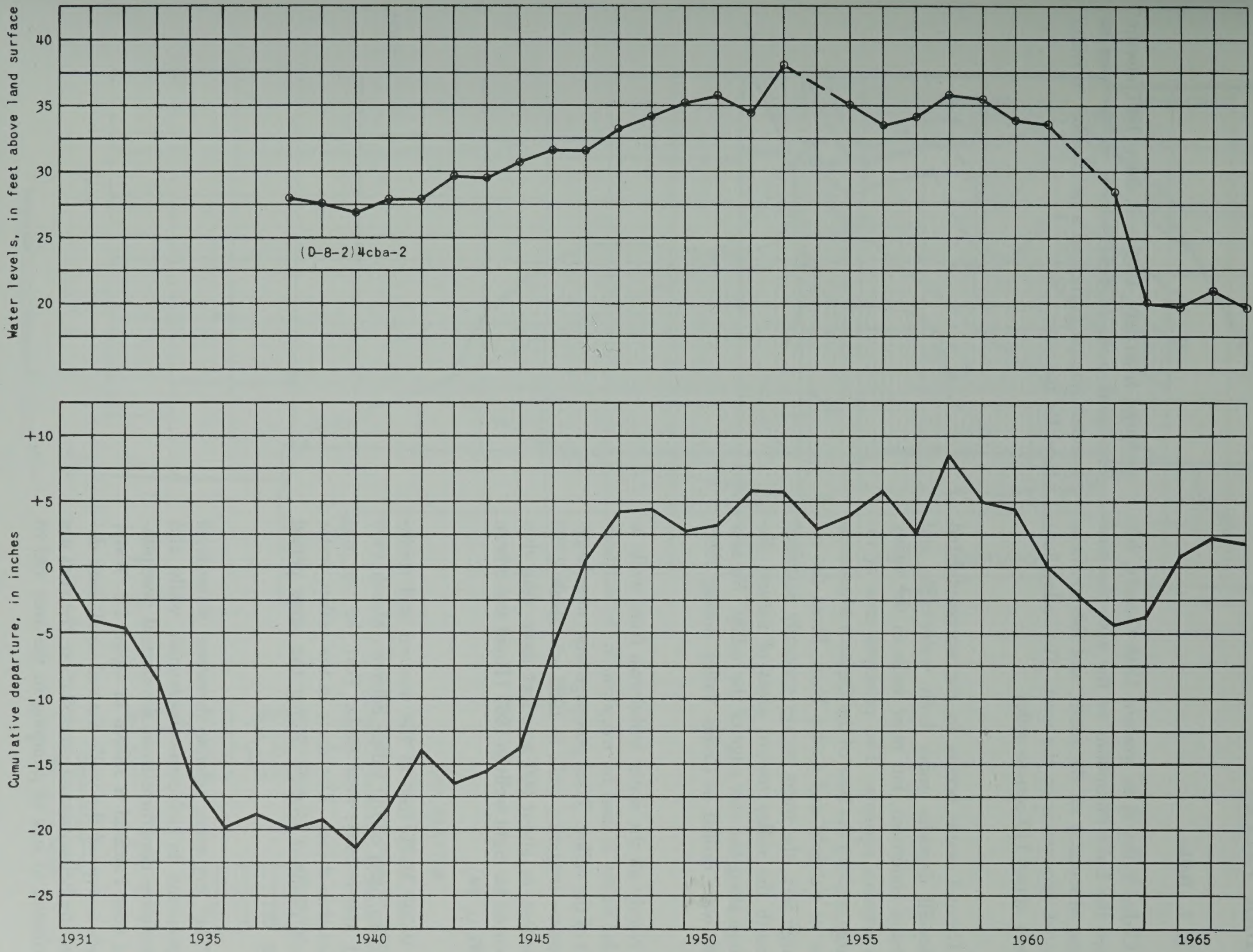


Figure 19.—Relation of water levels in well (D-8-2)4cba-2 near Lake Shore to cumulative departure from the 1931-60 normal annual precipitation at Payson.

CEDAR VALLEY

by E. L. Bolke

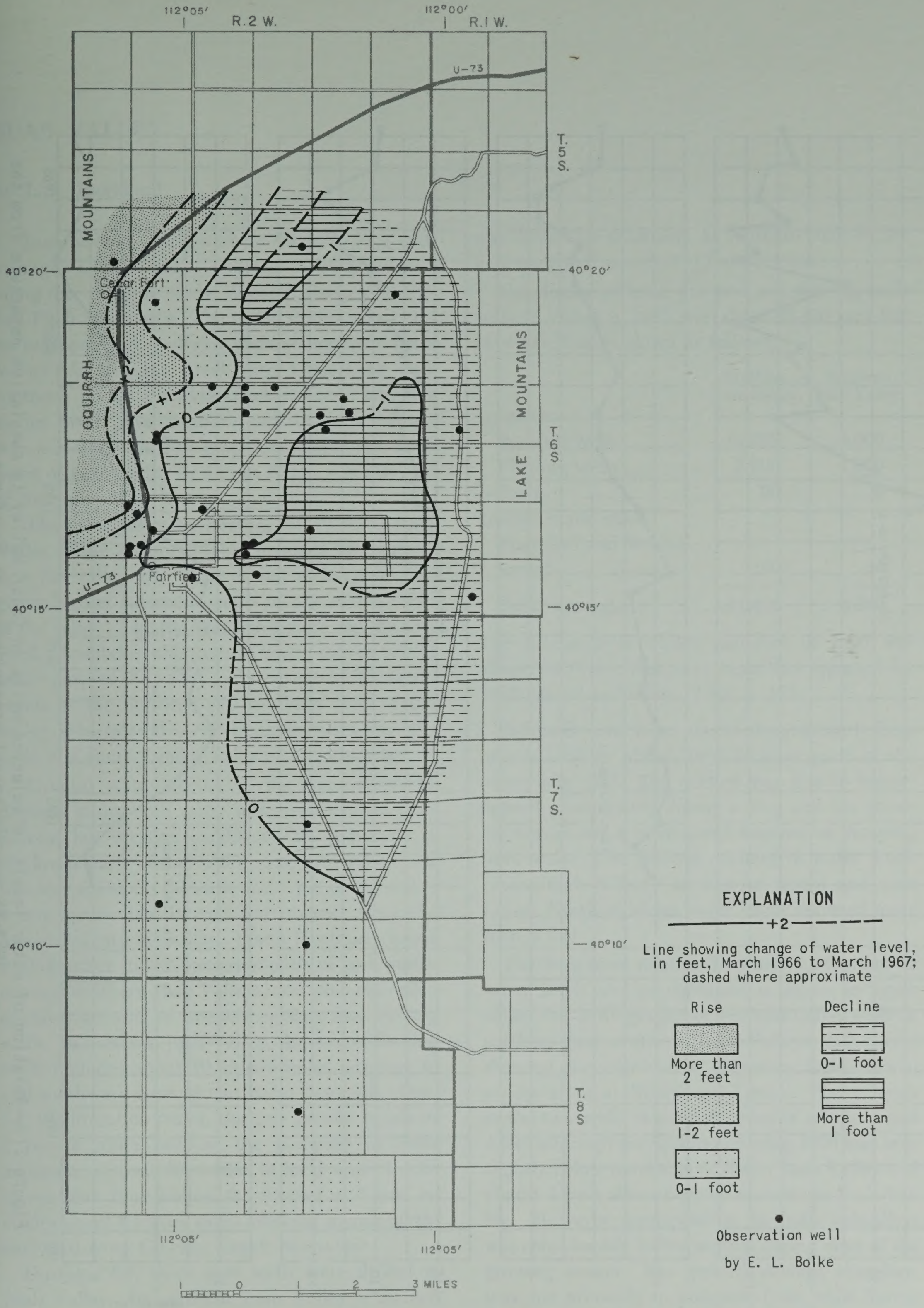
Cedar Valley is in western Utah County, between the Lake Mountains on the east, the East Tintic Mountains on the south, and the southern Oquirrh Mountains on the west. The valley floor covers about 140 square miles.

Ground water occurs in the unconsolidated valley-fill deposits under both water-table and artesian conditions, but most wells in the valley tap artesian aquifers. The principal area of recharge is along the base of the Oquirrh Mountains west of Fairfield and Cedar Fort. From the recharge area, the water moves generally eastward beneath the valley toward areas of natural discharge along the east edge of the valley. No new wells were drilled in Cedar Valley during 1966.

Nearly all the water withdrawn from wells in Cedar Valley is used for irrigation in the northern part of the valley. Total pumpage from nine large-diameter irrigation wells in 1966 was about 2,700 acre-feet, or about 900 acre-feet more than that reported for eight wells in 1965 (Hood and others, 1966, p. 44).

Water levels rose in the western and southwestern parts of the valley between March 1966 and March 1967; near Cedar Fort the rise was more than 2 feet. Elsewhere in the valley, water levels declined slightly during the same period (fig. 20).

The long-term relation between water-level fluctuations in selected observation wells and cumulative departure from the normal precipitation near Fairfield is shown in figure 21. Water levels in two of the wells showed small rises despite the below-normal precipitation; the rises are attributed to lack of pumping in the area and to recharge from late 1966 and early 1967 storms. The third well, (C-6-2)14cba-1, in the area of heaviest pumping, showed a net decline in water level for the year.



by E. L. Bolke

Figure 20.—Map of Cedar Valley showing change of water levels from March 1966 to March 1967.

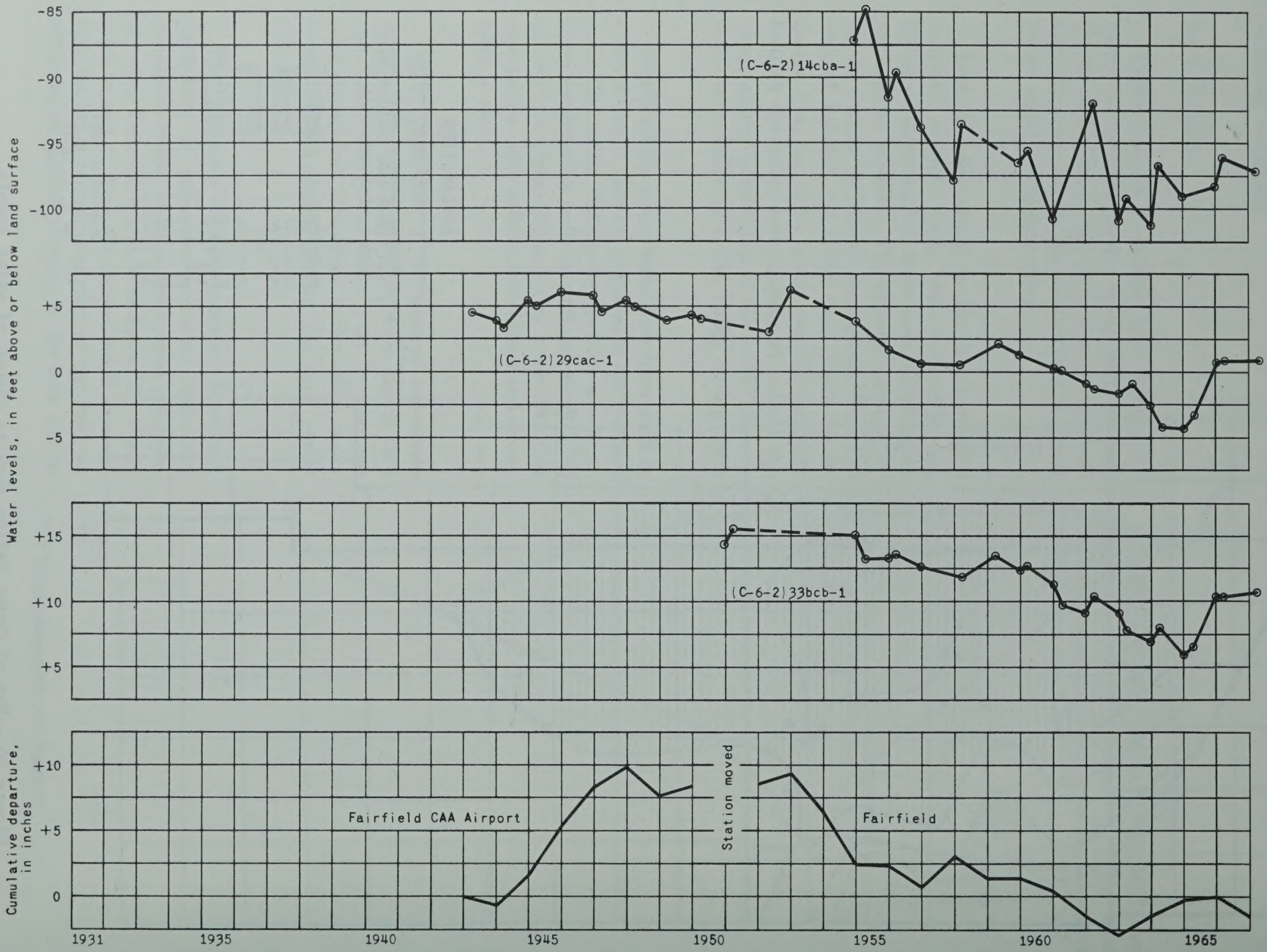


Figure 21.—Relation of water levels in selected wells in Cedar Valley to cumulative departure from the 1943-65 average annual precipitation at Fairfield.

JUAB VALLEY

by L. J. Bjorklund

Juab Valley, which is about 40 miles long and averages about 4 miles wide, is in central Utah along the west side of the Wasatch Range and the San Pitch Mountains. The valley drains near both its northern and southern ends – northern Juab Valley via Currant Creek into Utah Lake and southern Juab Valley via Chicken Creek into the Sevier River. The northern and southern subvalleys are separated topographically near the midpoint of Juab Valley by Levan Ridge, a gentle rise of the valley floor.

The principal water-bearing formation in Juab Valley is the unconsolidated deposits that constitute the valley fill. Most of the recharge to the ground-water reservoir occurs on the eastern side of the valley along the Wasatch Range and the San Pitch Mountains; the ground water moves to the lower parts of the valley and to eventual discharge points at the northern and southern ends of the valley. The ground-water divide between the subvalleys is about 2 miles south of Levan Ridge.

Ground water occurs in the unconsolidated deposits under both water-table and artesian conditions, but artesian conditions are prevalent in the lower parts of the valley. The greatest depths to water are along the eastern margin of the valley where permeable alluvial fans extend from the mountains into the valley. Water levels are closest to the surface in the lowermost parts of both northern and southern Juab Valleys, and each subvalley contains an area of artesian springs and flowing wells. In northern Juab Valley, the area of flowing wells includes about 10 square miles adjacent to and southward from Mount Nebo Reservoir. During the irrigation season the area shrinks by about 2 square miles because the pumping of wells creates a seasonal depression of local water levels. In southern Juab Valley, the flowing well area includes about 6 square miles adjacent to and northeastward from Chicken Creek Reservoir.

During 1966, three new wells were drilled in Juab Valley. In northern Juab Valley a 20-inch well was drilled for irrigation, and an 8-inch well was drilled for stock use. In southern Juab Valley a 12-inch well was drilled for stock use.

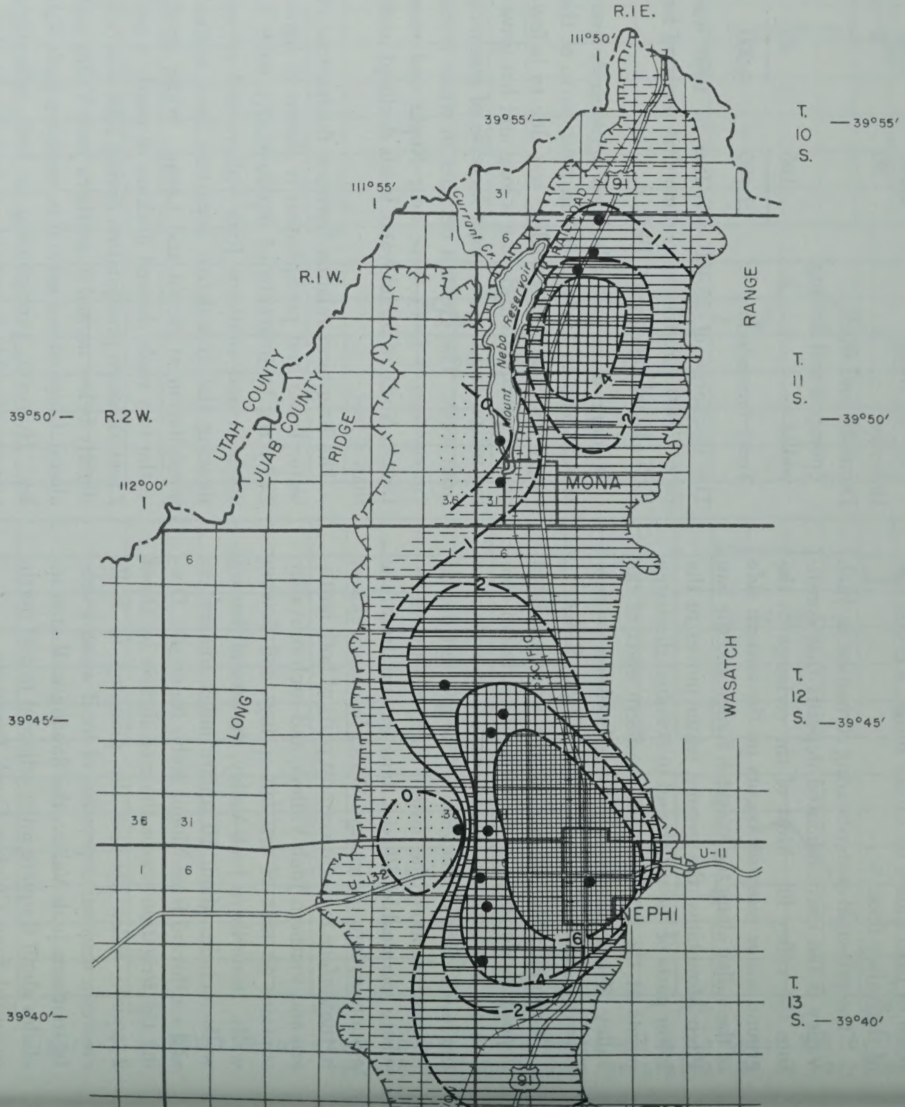
The discharge from pumped and flowing wells in Juab Valley in 1966 was about 25,400 acre-feet of water, broken down as follows:

	Northern Juab Valley	Southern Juab Valley
Irrigation		
Pumped wells	19,200	3,000
Flowing wells	2,000	1,000
Industry	50	0
Domestic and stock (pumped and flowing wells)	100	40
Total (rounded)	21,400	4,000

The discharge of 25,400 acre-feet in 1966 was about 7,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 47).

Ground-water levels declined significantly from March 1966 to March 1967 in most parts of the valley (fig. 22). The decline was due to below-normal precipitation during a long and hot growing season and a consequent increase of pumping from wells. The greatest declines in water levels (more than 6 feet) were near Nephi and near Levan. North of Mona water levels declined more than 4 feet.

The long-term relation between fluctuations of water levels and precipitation is shown in figure 23 by the hydrographs of representative wells in northern and southern Juab Valleys and curves showing the cumulative departure from normal precipitation at Nephi and Levan. Water levels in the two wells showed declines of nearly 4 and 2 feet although precipitation during 1966 was only slightly below normal in northern Juab Valley and almost 1 inch above normal in southern Juab Valley. However, precipitation in both subvalleys was considerably below normal during most of the growing season. The general decline, therefore, was due primarily to pumping from wells during a long growing season.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RANGE
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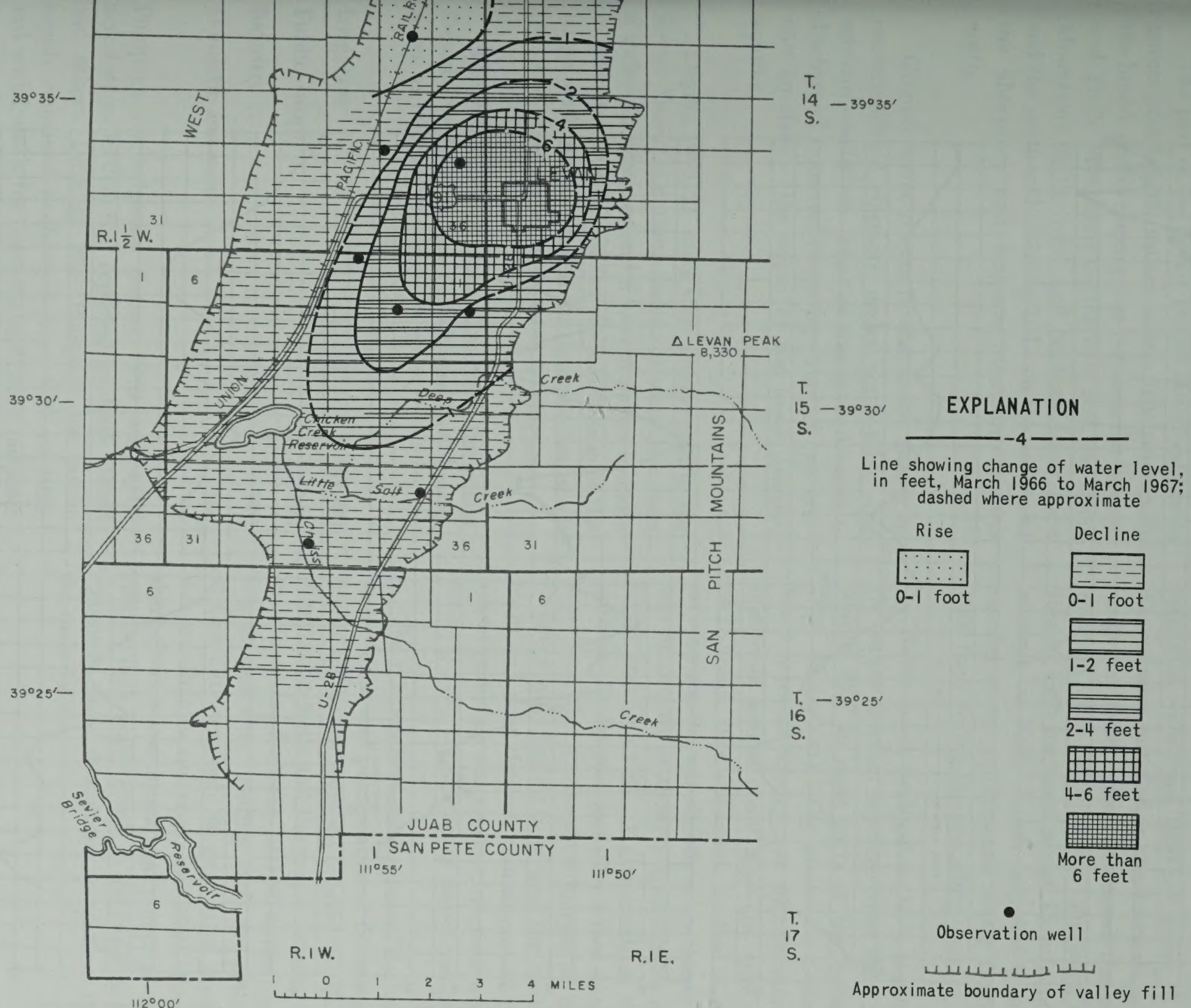

Base derived from general highway map

by L. J. Bjorklund

Figure 22.—Map of Juab Valley showing change of water levels from March 1966 to March 1967.

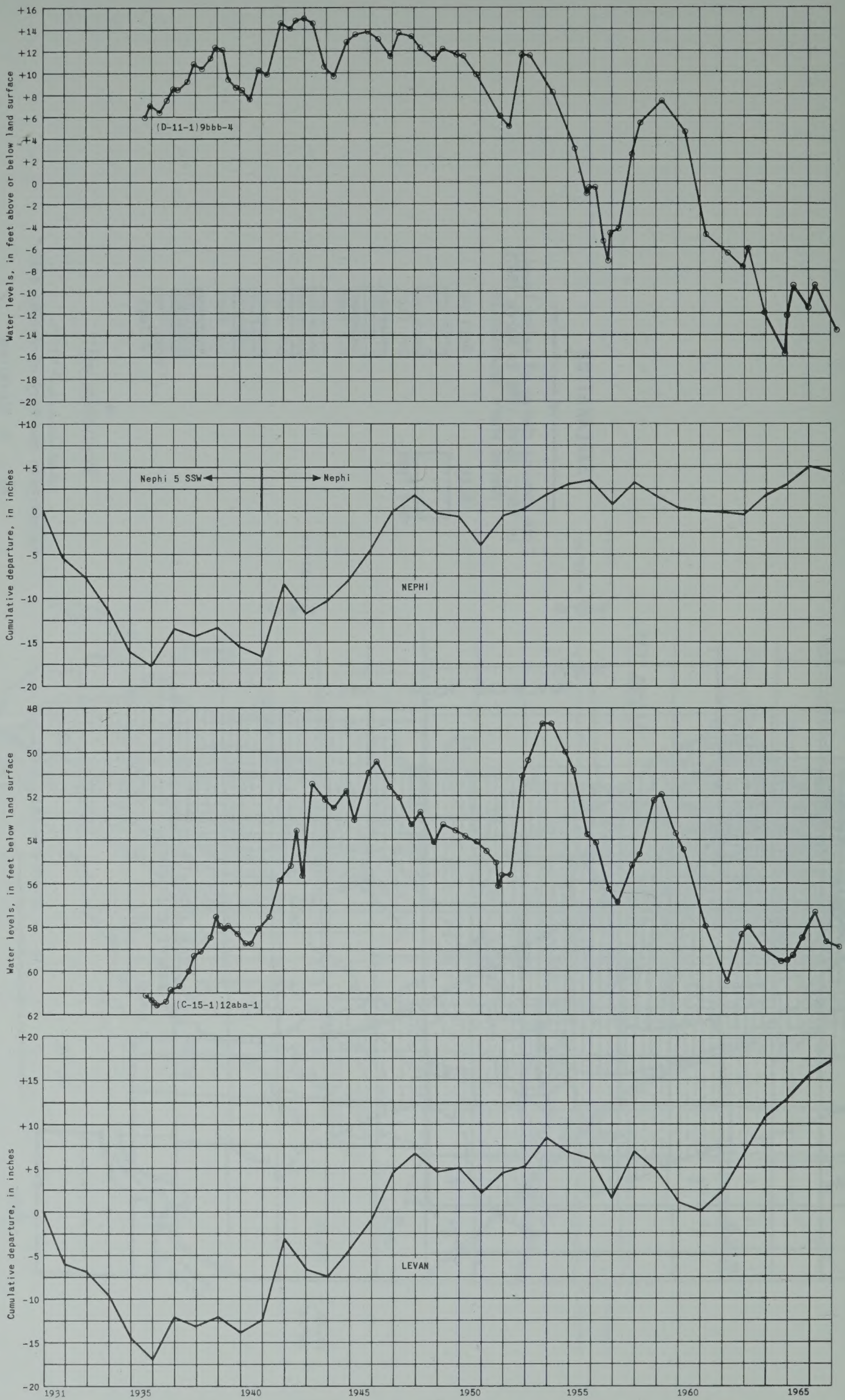

Figure 23.—Relation of water levels in wells (D-11-1)9bbb-4 and (C-15-1)12aba-1 to cumulative departure from the 1931-60 normal annual precipitation at Nephi and Levan.

SEVIER DESERT

by R. W. Mower

The part of the Sevier Desert described herein covers about 3,100 square miles. It is principally the broad, gently sloping area between the Canyon and Tintic Mountains on the east and the Drum Mountains on the west, and between Clear Lake and the north end of Sevier Lake on the south and the Sheeprock and Simpson Mountains on the north.

Ground water occurs in the Sevier Desert in unconsolidated deposits under water-table and artesian conditions. Most of the ground water is discharged from wells tapping either of two artesian aquifers – the upper or the lower artesian aquifer.

During 1966, 21 wells were constructed in the Sevier Desert. Of these wells, 13 were less than 6 inches in diameter and 8 were 6 inches or more in diameter. All the smaller wells and some of the larger wells were intended for domestic and stock use. The other larger wells were for irrigation.

The withdrawal of ground water in the Sevier Desert during 1966 was 31,300 acre-feet, broken down as follows:

Irrigation	30,000
Public supply	500
Industry	100
Domestic and stock	700

Pumpage for irrigation during 1966 was 4,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 52). Pumpage for public supply remained unchanged from 1965 to 1966, and withdrawals for domestic and stock purposes decreased 100 acre-feet. The total pumpage for irrigation and the cumulative number of pumped irrigation wells since 1950 are shown in figure 24. Pumps were installed on two formerly unequipped irrigation wells, which increased the number of pumped wells by 5 percent. Pumpage for irrigation in 1966 increased about 15 percent over the amount in 1965. Lands irrigated from streams needed more supplemental water from wells in 1966 than during the preceding year.

Water levels declined in both the lower and the upper artesian aquifers from March 1966 to March 1967 in most parts of the Sevier Desert (figs. 25 and 26). The maximum decline in the lower artesian aquifer was slightly more than 4 feet in an area of about 2 square miles southeast of Lynndyl. The maximum decline in the upper artesian aquifer was slightly more than 3 feet and was in an area of about 5 square miles near Fool Creek and Oak City. Water levels in the upper artesian aquifer rose less than 1 foot in two small areas near the northeastern margin of the basin. Declines were largest in or near the center of the basin and near the east central part of the basin where pumpage was greatest; declines were smallest away from the centers of heavy pumping.

The relation between long-term fluctuations of water levels and precipitation is illustrated in figure 27 by the hydrographs of water levels in three observation wells and the graph showing cumulative departure from the 1931-60 normal precipitation at Oak City. During 1966 the precipitation at Oak City was only 86 percent of normal, and was less than in any year since 1960. Because recharge was below normal and pumpage was at an all-time high, water levels in the observation wells continued on a downward trend that began in the early 1950's.

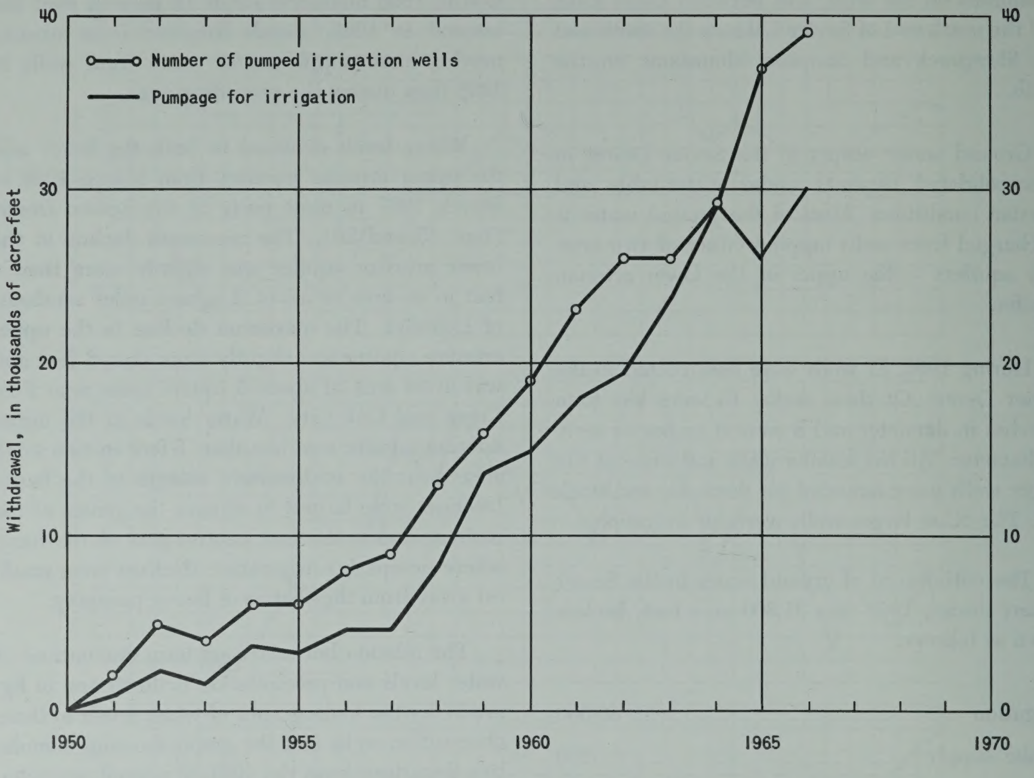

Figure 24.—Relation of number of pumped irrigation wells to pumpage for irrigation in the Sevier Desert, 1950-66.

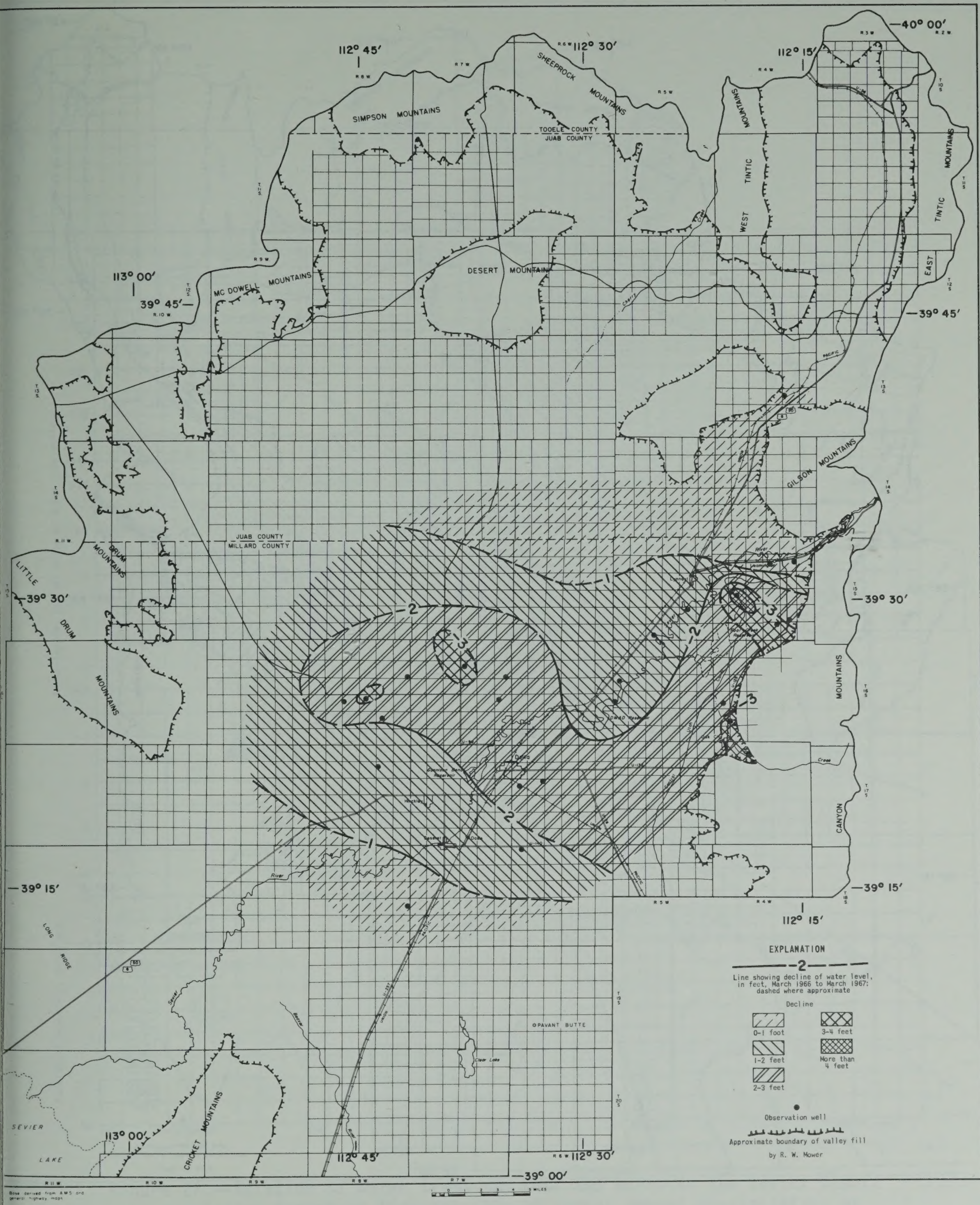

Figure 25.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1966 to March 1967.

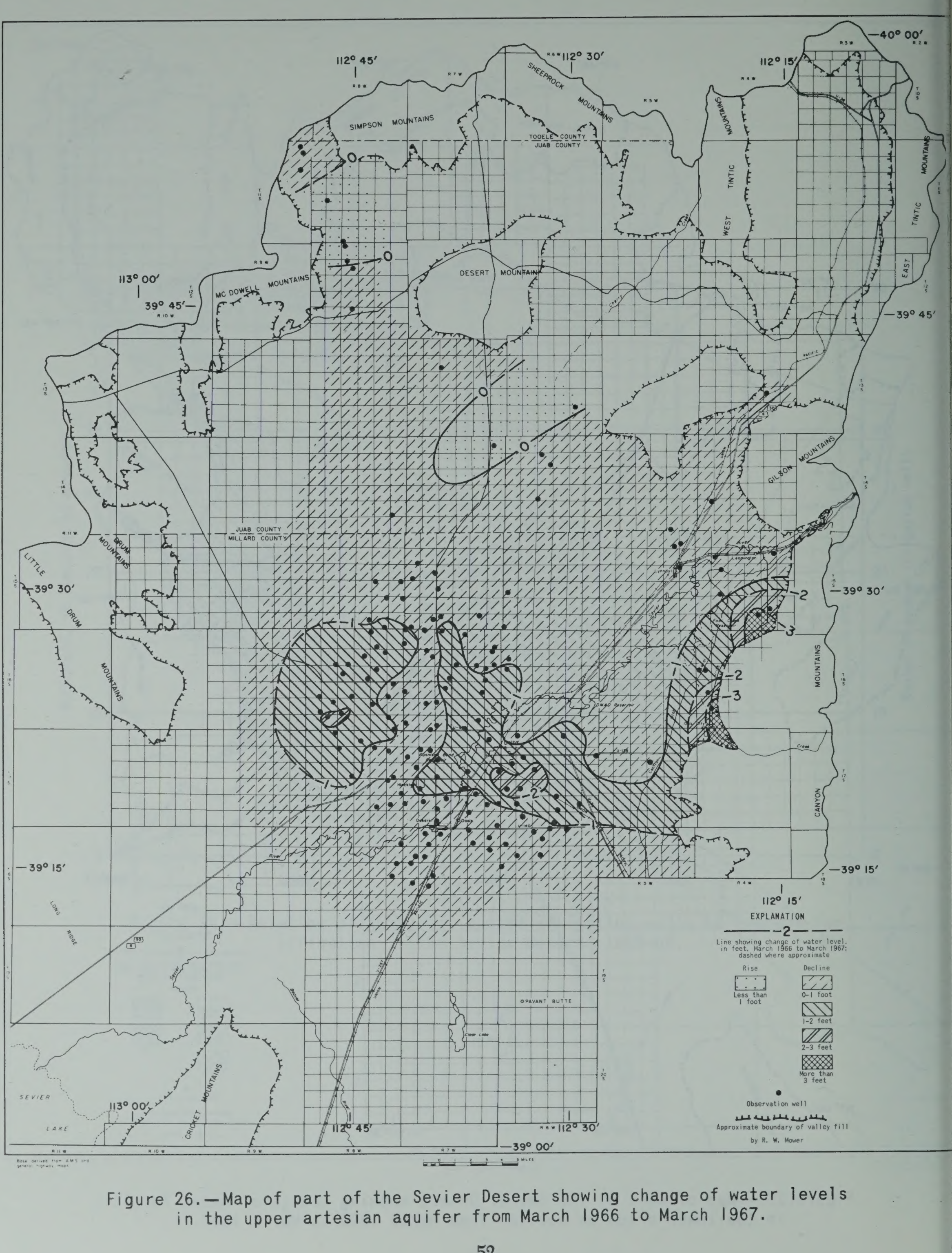

Figure 26.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1966 to March 1967.

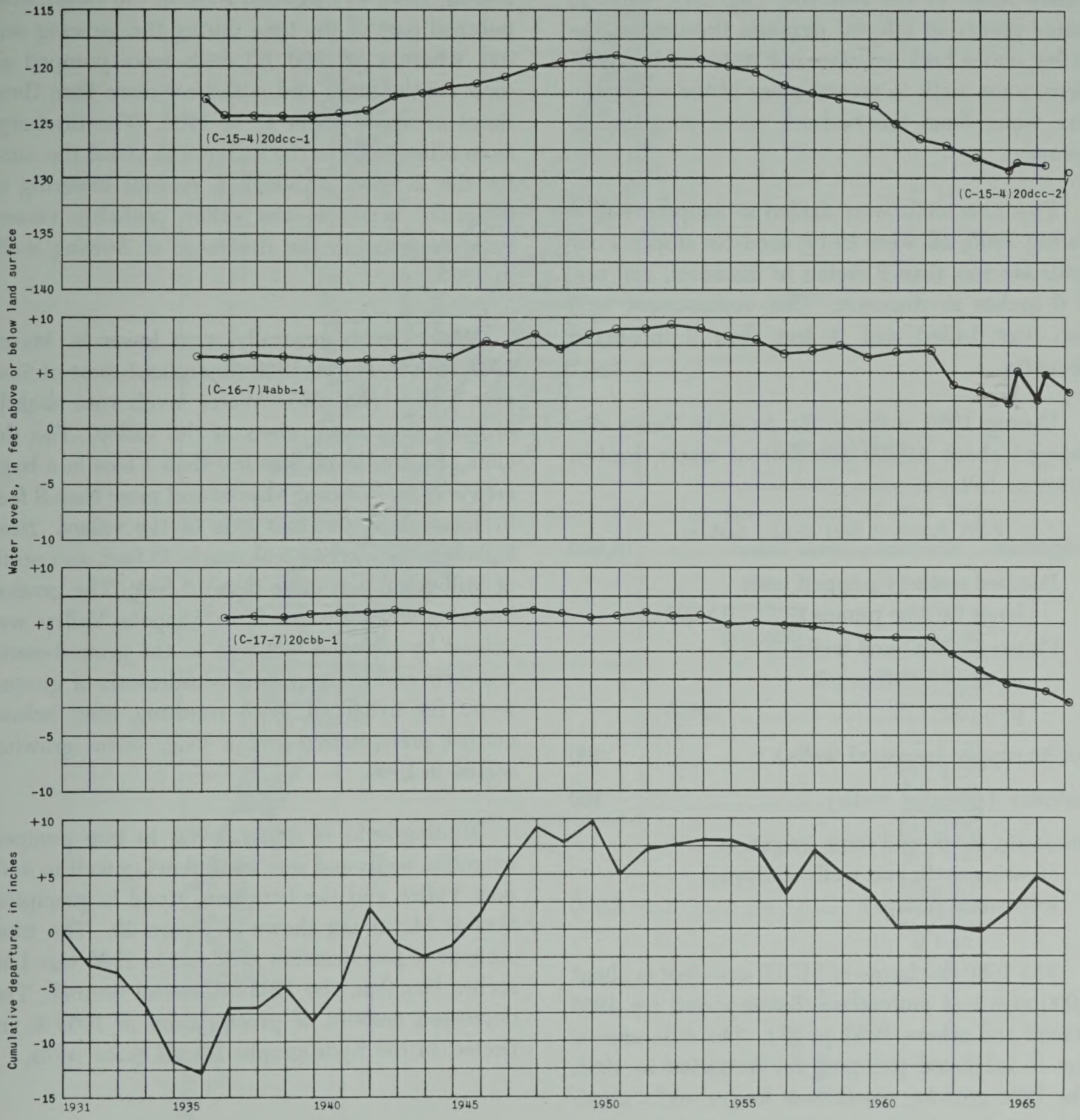

Figure 27.—Relation of water levels in selected wells in the Sevier Desert to cumulative departure from the 1931-60 normal annual precipitation at Oak City.

SANPETE VALLEY

by G. B. Robinson, Jr.

The Sanpete Valley includes the area north of Nine Mile Reservoir near Sterling and the Arapien Valley south of the reservoir (fig. 28). Ground water occurs in alluvial deposits throughout the valley under both artesian and water-table conditions; some wells in several areas of the valley derive water from the bedrock underlying the alluvium.

Five new wells were drilled in Sanpete Valley during 1966; all were to be used for stock. Four wells are less than 6 inches in diameter, and one is 6 inches in diameter. One replacement well also was drilled and is less than 6 inches in diameter.

During 1966, wells in the Sanpete Valley discharged about 21,100 acre-feet of water, broken down as follows:

Irrigation		16,800
Pumped wells (equipped with large turbine pumps)	13,200	
Flowing wells (and wells equipped with small pumps)	3,600	
Public supply (pumped wells)		400
Industry (pumped wells)		400
Domestic, stock, and some irrigation (flowing wells and wells equipped with small pumps)		3,500

The 1966 discharge of 21,100 acre-feet is about 9,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 58). The difference is due to increased pumping for irrigation in 1966. The 1966 growing season was longer and warmer than usual, and the precipitation was below normal. The amount of surface water available for irrigation, therefore, was less than average in a year of above-average demand, and more ground water was needed to supplement surface supplies. During 1965, 44 irrigation wells in the valley were pumped part of the time during the growing season, whereas in 1966, 60 wells were pumped almost continuously and withdrew more than three times as much water as in 1965. The discharge from other wells in the valley was about the same for the 2 years, although a general lowering of hydraulic heads in the valley probably caused some decrease in the discharge of flowing wells in 1966.

Water levels generally were lower in March 1967 than in March 1966 throughout most of Sanpete Valley (fig. 28). Water levels rose slightly in only three small areas in the valley. The decline of water levels was less than 1 foot in a large area centered around Moroni and more than 9 feet in areas along the east side of the valley. Near Ephraim, the decline was nearly 13 feet, and north of Milburn it was more than 15 feet. The general lowering of water levels in Sanpete Valley was caused by reduced recharge to the ground-water reservoir and by increased withdrawals of ground water for irrigation, both resulting from below-normal precipitation and a long, warm growing season in 1966.

Hydrographs of water levels in two pumped irrigation wells and one small flowing well in Sanpete Valley and the long-term trend in precipitation at Manti are shown in figure 29. The total amount of precipitation at Manti in 1966 was 1.40 inches less than the 1931-60 annual normal. The decreased amount of precipitation in 1966 is reflected in the hydrographs for all three wells.

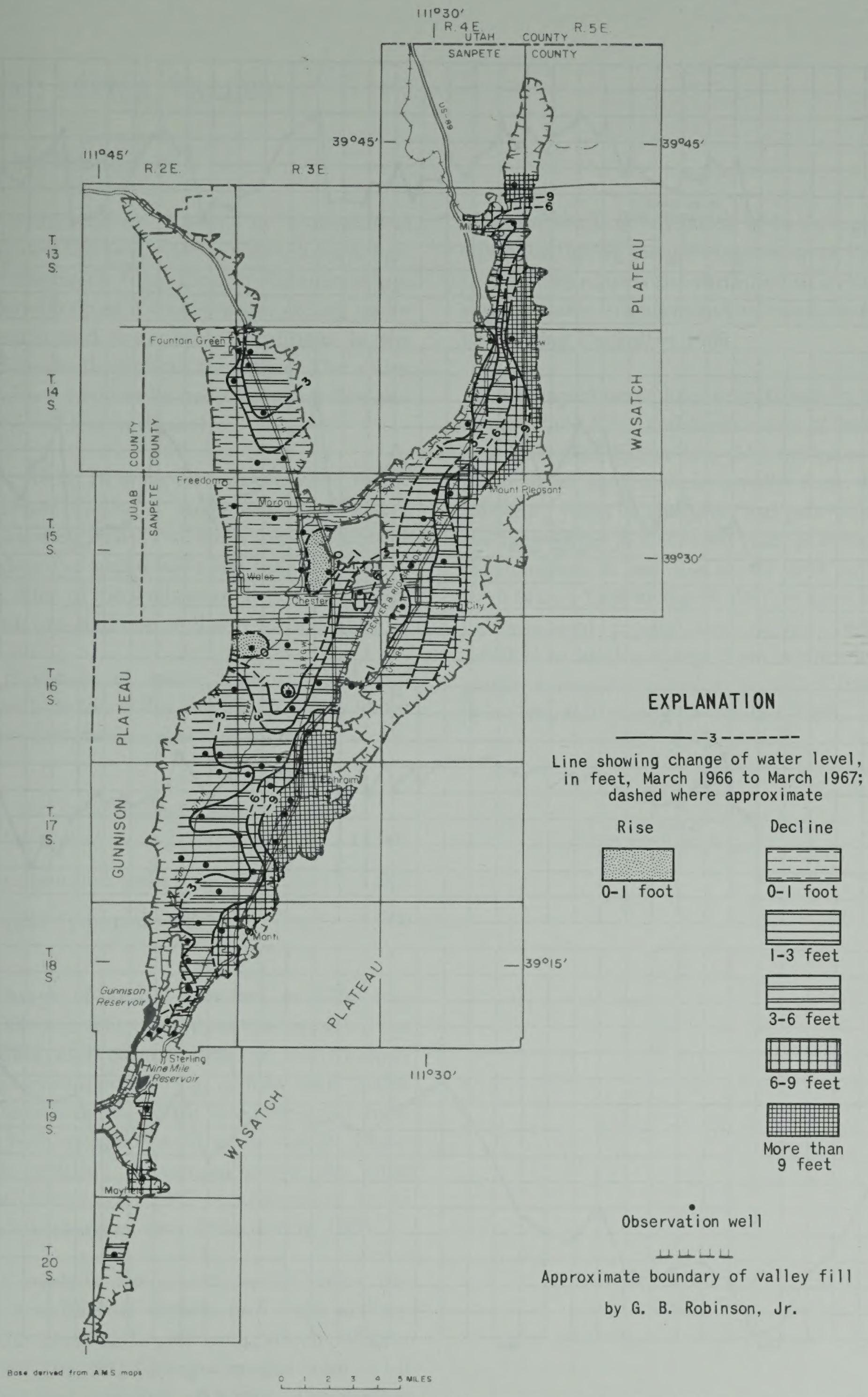

Figure 28.—Map of Sanpete Valley showing change of water levels from March 1966 to March 1967.

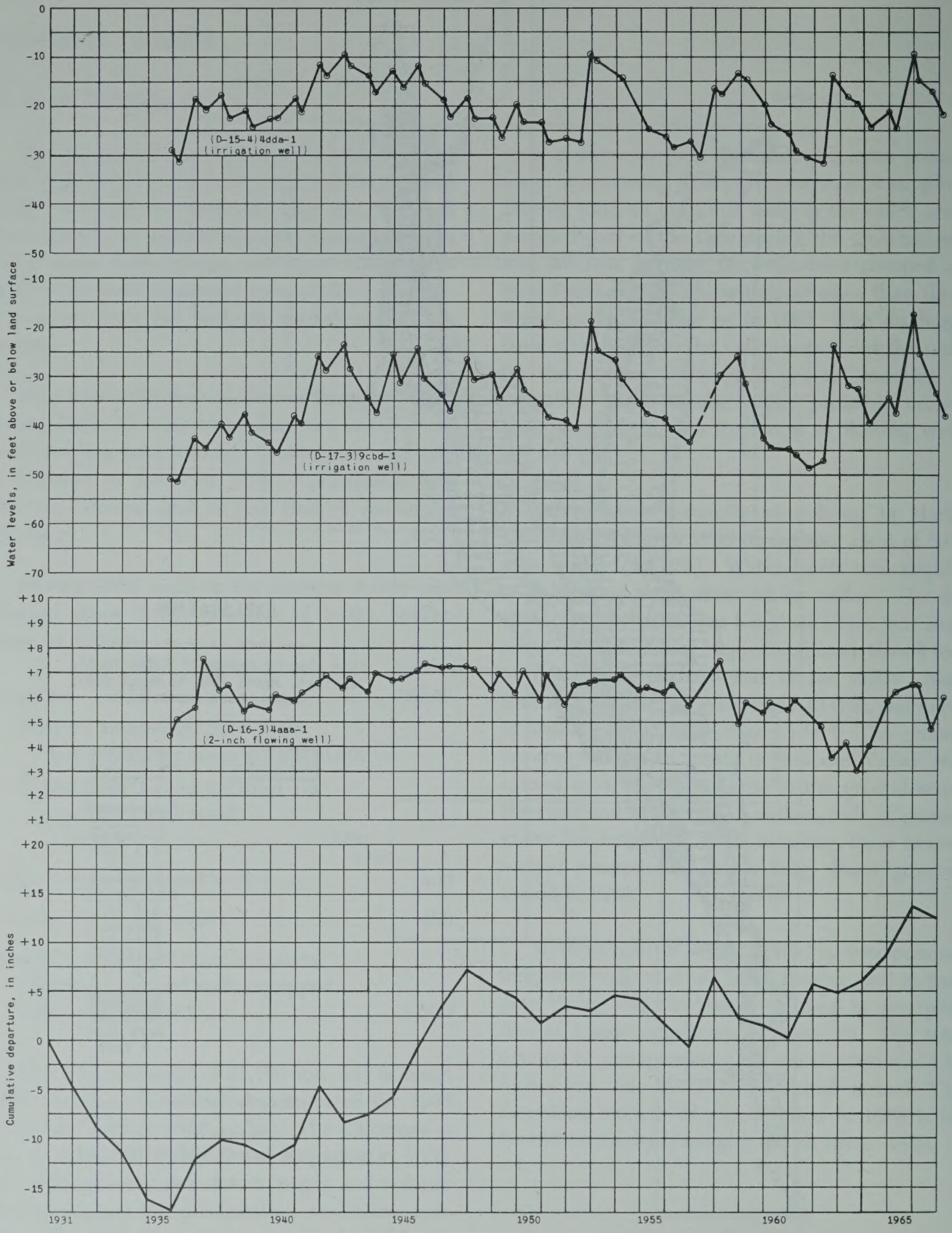

Figure 29.—Relation of water levels in three wells in the Sanpete Valley to cumulative departure from the 1931-60 normal annual precipitation at Manti.

CENTRAL SEVIER VALLEY

by L. J. Bjorklund

The central Sevier Valley, in south-central Utah, includes the Sevier River valley from Kingston downstream to Yuba Dam, a distance of approximately 90 miles. Ground water occurs under both artesian and water-table conditions in the alluvial deposits throughout the valley. The valley contains about 1,300 wells, many of which flow and are 4 inches or less in diameter.

During 1966, 10 wells were constructed in the central Sevier Valley; 8 wells were new and 2 replaced existing wells. Two wells were 6 inches or more in diameter and 8 were less than 6 inches in diameter. Nine of the wells were drilled for domestic or stock use, and one well was for irrigation.

The discharge of water from pumped and flowing wells in the valley during 1966 was about 16,200 acre-feet, broken down as follows:

Irrigation and some domestic and stock use (flowing wells)	14,000
Irrigation (pumped wells)	1,200
Public supply (pumped wells)	1,000

The discharge of 16,200 acre-feet in 1966 was about 1,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 62). Below-normal precipitation during a long and warm growing season increased the need for water from wells for both irrigation and public supply. Flowing wells probably discharged about the same amount of water as in 1965 because water levels in the valley changed very little during 1966.

Water levels in the central Sevier Valley declined in 6 wells, rose slightly in 5 wells and remained the same in 1 well from March 1966 to March 1967 (fig. 30) Changes ranged from +1.0 to –5.7 feet and averaged –0.8 foot. The decline of water levels is attributed to below-normal precipitation during the growing season of 1966; small rises in water levels are attributed to recharge from surface-water irrigation and to excessive precipitation during December 1966.

A comparison of long-term trends in precipitation at Piute Dam and fluctuations of water levels in a well near Salina (fig. 31) indicates that the water level in the well usually rises during or following years of above-normal precipitation and declines during or following years of below-normal precipitation. A net rise of 0.1 foot in the well from March 1966 to March 1967, in spite of slightly below-normal precipitation during 1966, is attributed to local recharge from surface-water irrigation during the growing season of 1966 and to heavy rainfall during December 1966.

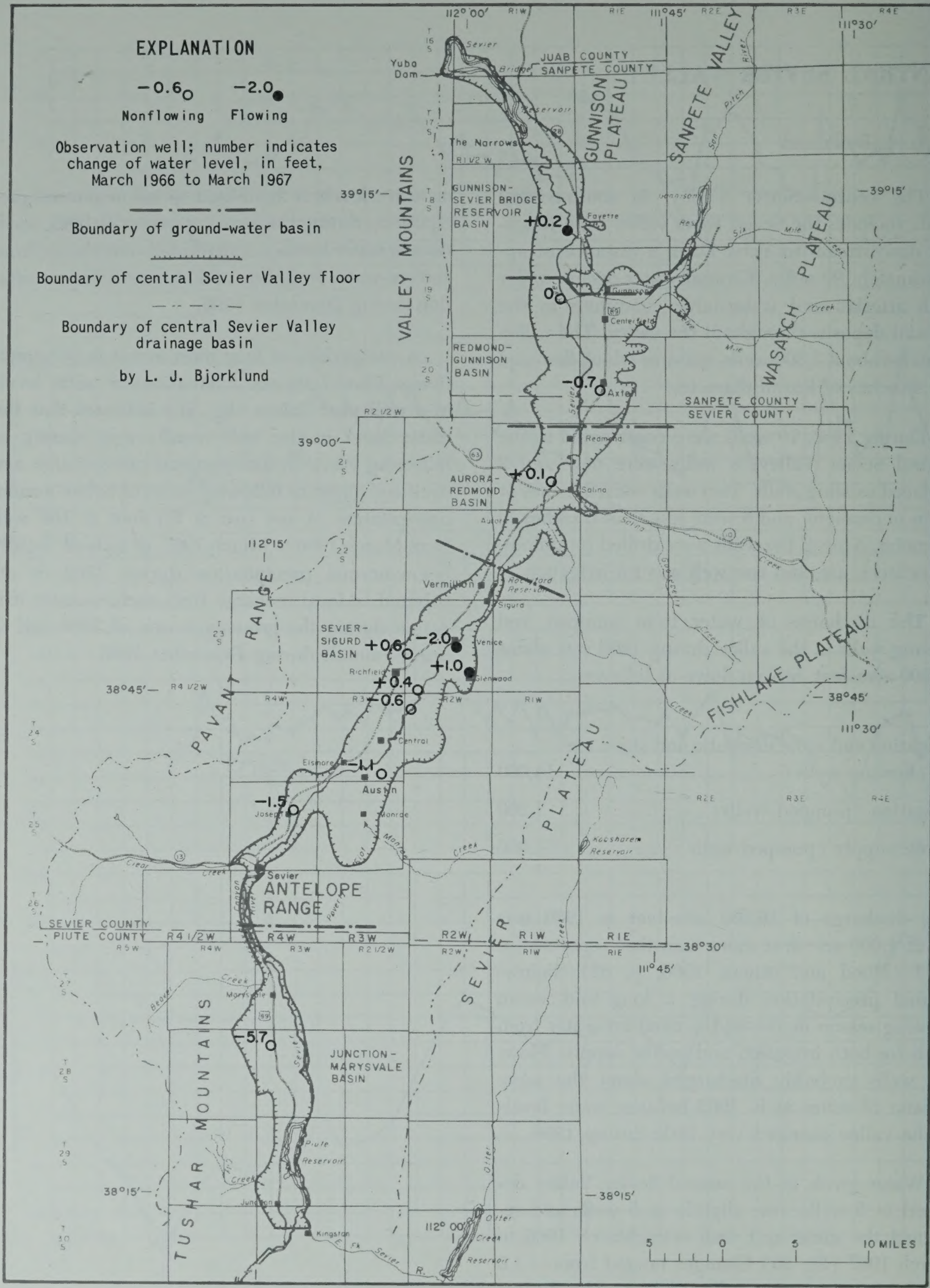

Figure 30.—Map of the central Sevier Valley showing change in water levels from March 1966 to March 1967.

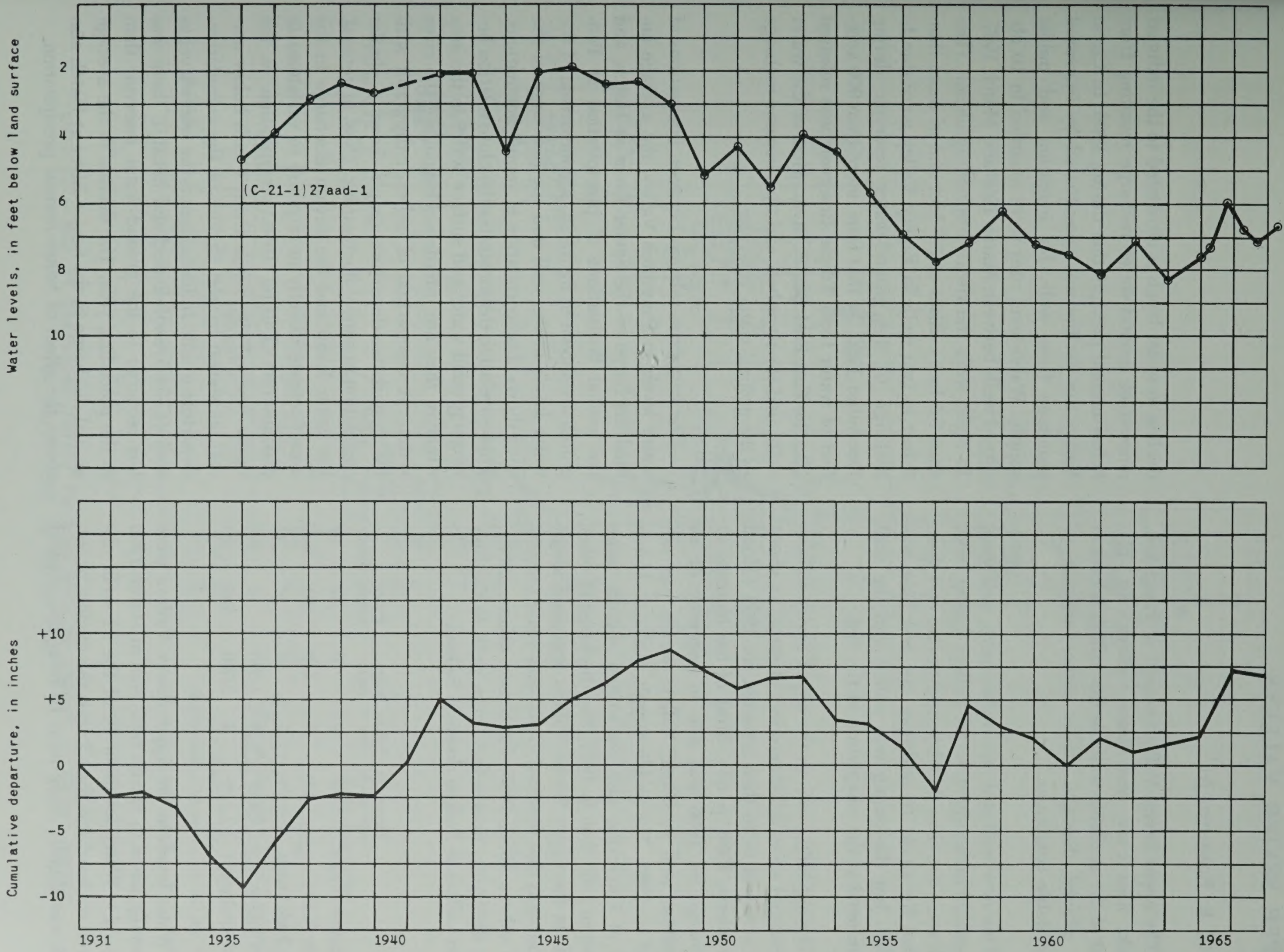

Figure 31.—Relation of water levels in well (C-21-1)27aad-1 near Salina to cumulative departure from the 1931-60 normal annual precipitation at Piute Dam.

UPPER SEVIER VALLEYS

by G. B. Robinson, Jr.

The upper Sevier Valleys consist of Panguitch, Circle, East Fork, and Grass Valleys (fig. 32). Most of the available water in the valleys occurs in the alluvial deposits, under either artesian or water-table conditions.

One new well and one replacement well were completed in the upper Sevier Valleys during 1966; both were less than 6 inches in diameter and were drilled for stock. In addition, one test hole was drilled, but the casing was pulled and the well abandoned at the completion of the test.

During 1966, wells in the upper Sevier Valleys discharged about 3,300 acre-feet of water, or about 700 acre-feet more than reported for 1965 (Hood and others, 1966, p. 65). Most of the increase in discharge for 1966 was due to pumping of an irrigation well in Circle Valley, which was not used in 1965. The public-supply wells at Hatch and at Circleville also discharged slightly more water in 1966 than in 1965. The discharge of other wells in the upper Sevier Valleys remained about the same as that reported in previous years (Arnow and others, 1964, 1965; Hood and others, 1966). The discharge, in acre-feet, from wells in the four main valleys is broken down as follows:

	Domestic and stock	Indus-try	Irriga-tion	Public supply	Total
Panguitch Valley ..	5	0	0	46	51
Circle Valley	10	3	716	101	830
East Fork Valley	5	0	0	40	45
Grass Valley	1,100	0	1,300	0	2,400
Total (rounded)	1,100	3	2,000	190	3,300

Water levels in the upper Sevier Valleys were generally lower in March 1967 than in March 1966 (fig. 32). Water levels in 10 of the 21 wells observed declined less than 2 feet; the decline in one well was slightly more than 10 feet. The general decline in water levels is attributed to the reduced amount of ground-water recharge resulting from below-normal precipitation during 1966. In Circle Valley the decline was accentuated by increased pumpage from wells for irrigation and public supply. Water-level rises were recorded in 10 observed wells between March 1966 and March 1967. In eight wells the rises were not significant (less than 0.5 foot). Rises of 0.6 foot and of more than 3 feet in two wells in Emery Valley were due to recharge to the ground-water reservoir during December 1966. At that time, more than 900 acre-feet of water from Tropic Reservoir was released into the East Fork Sevier River. Most of the water infiltrated the river bed, and thus became recharge to the ground-water reservoir.

The long-term relation between fluctuations of water levels in Panguitch Valley, the average annual discharge of the Sevier River at Hatch, and the annual fluctuations of precipitation at Panguitch are shown in figure 33. A comparison of the water levels in the well and the discharge of the river shows close correlation in annual fluctuations. This correlation demonstrates the close relation between ground water and surface water in the area —that is, they are interdependent along the river system. A comparison of either hydrograph with the cumulative-departure graph shows a similar correlation in annual fluctuations. Thus, in general, the water levels and the stream discharge in the area fluctuate directly in response to variations in precipitation. During 1966, precipitation in the upper Sevier Valleys was about 1 inch below normal, as shown by the decline of the cumulative-departure graph. In like manner, the water level in well (C-34-5)8adb-2 declined because there was less recharge to the ground-water reservoir than in the preceding year. The decline in the average annual discharge in the Sevier River at Hatch also shows the effect of below-normal precipitation.

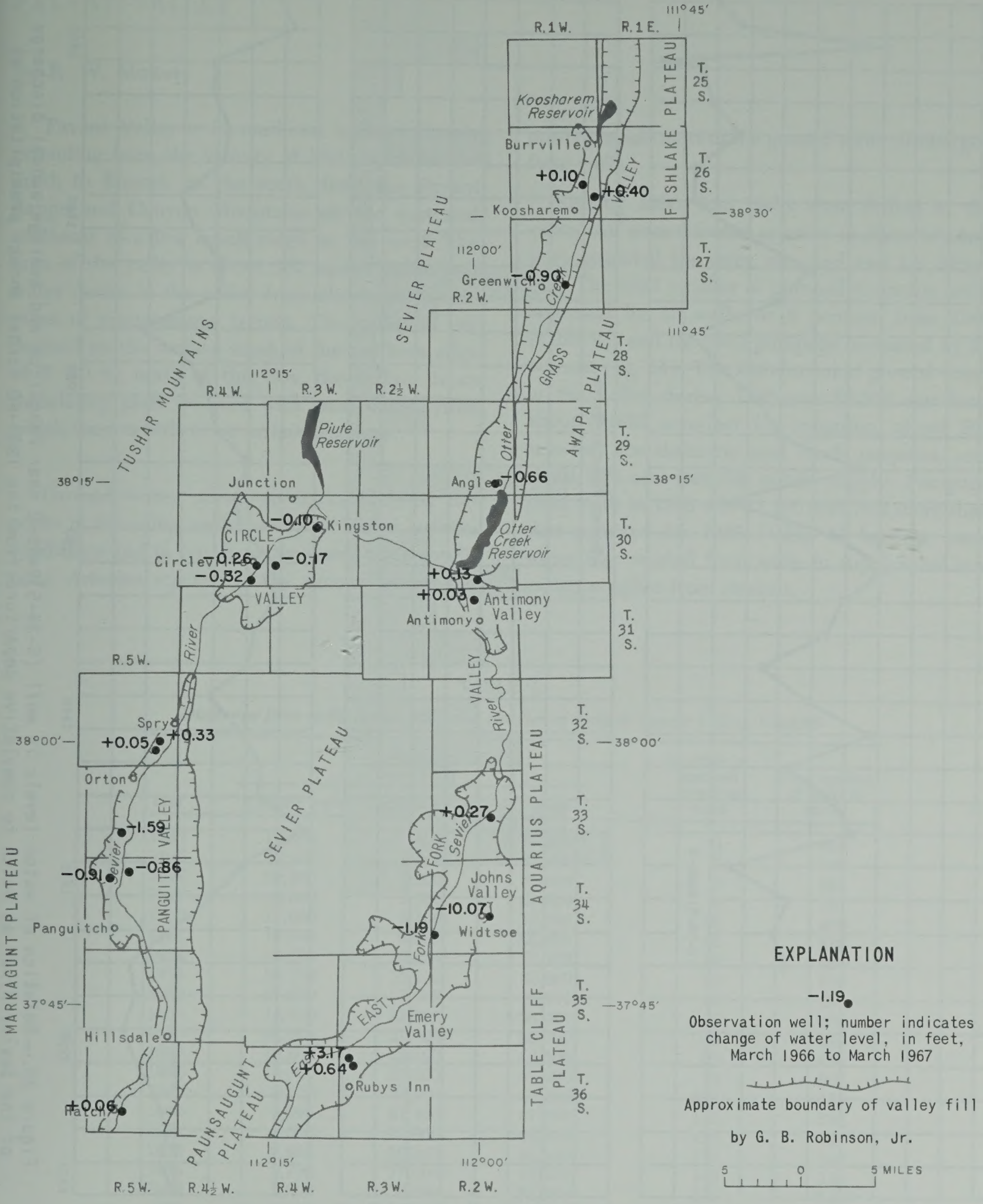

Figure 32.—Map of the upper Sevier Valleys showing change in water levels from March 1966 to March 1967.

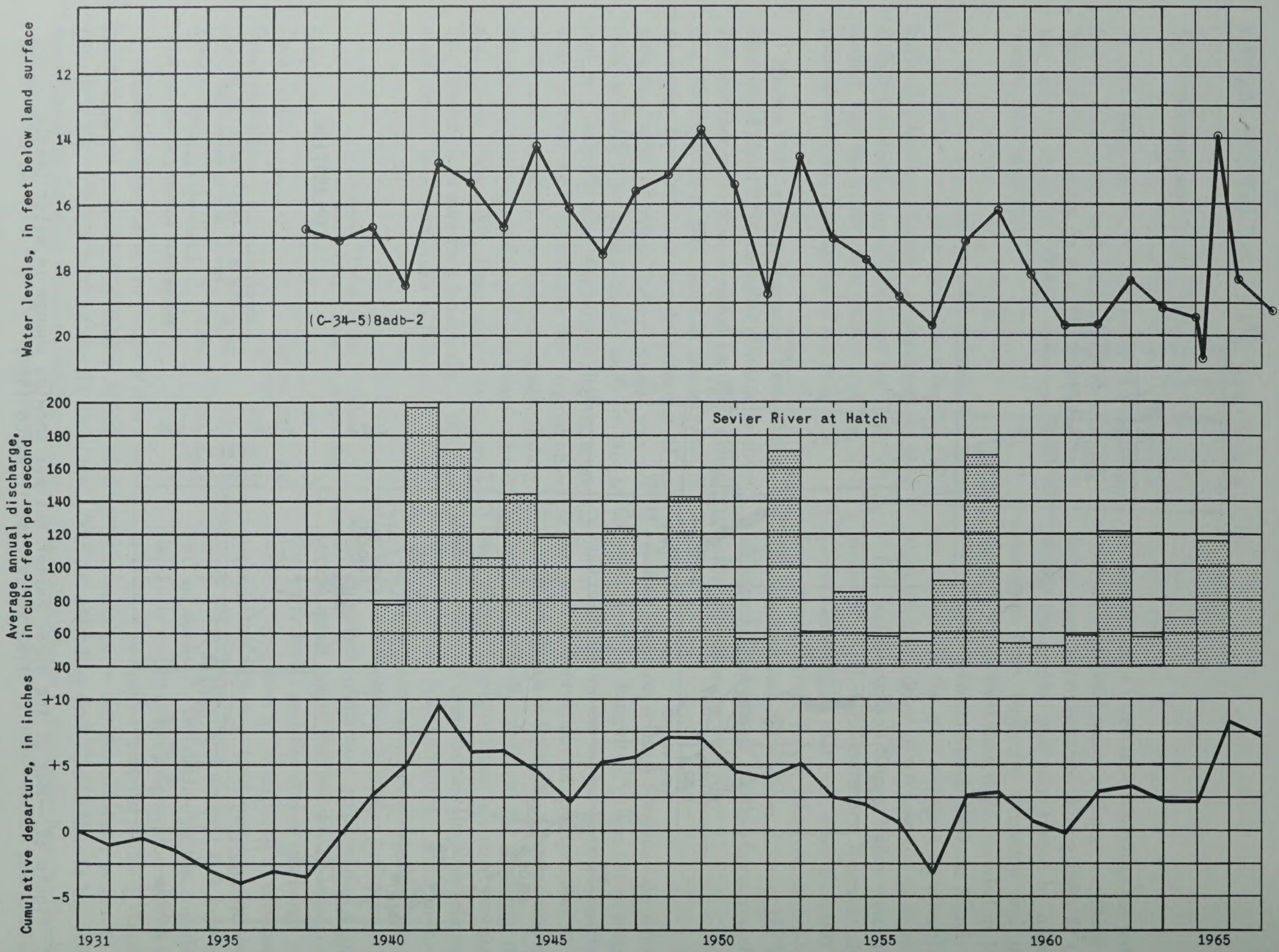

Figure 33.—Relation of water levels in well (C-34-5)8adb-2 near Panguitch and average annual discharge of the Sevier River at Hatch to cumulative departure from the 1931-60 normal annual precipitation at Panguitch.

PAVANT VALLEY

by R. W. Mower

Pavant Valley is in southeast Millard County extending from the vicinity of McCornick on the north to Kanosh on the south, from the Pavant Range and Canyon Mountains on the east and northeast to a low basalt ridge on the west. The area of the valley is about 300 square miles, and water drains to the valley from about 500 square miles of mountainous terrain. The valley is undrained on the surface south of the southern edge of T. 20 S.; north of this line, the surface is an undulating plain covered with sand dunes, from which there is little or no surface drainage.

Ground water occurs in unconsolidated deposits in the valley under water-table and artesian conditions and in basalt under water-table conditions. Artesian aquifers in the unconsolidated deposits provide most of the ground water discharged from wells.

During 1966, four wells were drilled in the valley. All were 6 inches or more in diameter; two were intended for stock use, and two for irrigation. The total number of pumped irrigation wells increased by 10 wells, or 8 percent, from 1965 (table 4), and the total pumpage increased by 29 percent (fig. 34). The withdrawal of ground water in the valley during 1966 was 88,500 acre-feet: about 88,000 acre-feet for irrigation, about 300 acre-feet for domestic and stock purposes, and about 200 acre-feet for public supply. Pumpage from wells in 1966 was 21,100 acre-feet more than that reported for 1965 (table 4) because more water was needed from wells to supplement irrigation supplies from streams.

TABLE 4.

Discharge from wells (estimated) and number of wells in Pavant Valley, 1946-66

Year	Discharge (acre-feet)			Number of pumped irrigation wells	Total number of wells in valley
	Flowing wells	Pumped wells	Total		
1946	17,300	400	17,700	3	343
1947	17,400	1,000	18,400	5	349
1948	19,400	1,200	20,600	5	351
1949	18,600	2,200	20,800	8	367
1950	17,600	5,100	22,700	20	400
1951	16,500	9,800	26,300	33	413
1952	16,600	10,800	27,400	39	424
1953	18,700	15,100	33,800	46	445
1954	17,500	17,900	35,400	45	451
1955	14,400	21,600	36,000	49	466
1956	11,000	27,000	38,000	56	485
1957	10,200	32,300	42,500	65	498
1958	10,000	37,000	47,000	73	507
1959	6,300	53,300	59,600	101	522
1960	5,900	61,400	67,300	110	532
1961	4,500	61,800	66,300	113	535
1962	3,600	58,200	61,800	117	540
1963	2,700	77,000	79,700	133	542
1964	2,500	70,000	72,500	133	548
1965	2,700	66,100	68,800	129	555
1966	1,300	87,200	88,500	139	559

Water levels declined from March 1966 to March 1967 in Pavant Valley (fig. 35). The average net decline in water level in the valley was 2.4 feet in contrast to an average rise of 0.5 foot, observed from March 1965 to March 1966.

Maximum observed declines were slightly more than 5 feet in the Flowell, Meadow, and Kanosh districts, more than 3 feet in the Greenwood and Pavant districts, and nearly 2 feet in the McCornick district. The maximum declines were in areas where pumped irrigation wells were concentrated or where the amount of recharge was small.

Water levels declined throughout Pavant Valley during the main part of the 1966 irrigation season from March to August 1966 (fig. 36). Maximum seasonal declines exceeded 40 feet in the Flowell, Meadow, and Pavant districts, were between 20 and 30 feet in the McCornick district, were between 10 and 20 feet in the Kanosh district and were slightly less than 10 feet in the Greenwood district. The average seasonal decline in the valley was 10.6 feet, but in individual districts the average declines ranged from 3.6 feet in the Greenwood district to nearly 20 feet in the Flowell district.

The relation between long-term fluctuations of precipitation and water levels is illustrated in figure 37 by the cumulative-departure graph for precipitation at Fillmore and a hydrograph of the water level in an observation well in each of the six ground-water districts. Precipitation at Fillmore was nearly normal during 1966. Water levels during 1966 declined from 0.6 to 5.3 feet in the wells shown in figure 37 and continued the downward trend that began between 1947 and 1955. These changes suggest that withdrawal of water exceeded recharge in all the ground-water districts.

The concentration of dissolved solids in ground water ranges widely in Pavant Valley. The lowest concentrations are near the east margin of the valley, as at well (C-23-5)5acd-1 in the southeastern part of the Meadow district, where the concentration is less than 500 ppm (parts per million); the highest concentrations are near the west margin, as at well (C-23-6)8abd-1 near the northwest edge of the center of pumping in the Kanosh district, where the concentration of dissolved solids exceeds 4,300 ppm (fig. 38). The concentration of dissolved solids usually changes inversely with a change in the rate of recharge. Recharge was at or below normal during 1966, and consequently the concentration remained about the same or increased in 1966 from what it was in 1965 in all the wells sampled (fig. 38). The greatest increase in concentration was in well (C-23-6)8abd-1, which is in an area removed from the effect of direct recharge and which discharges water that has been concentrated by recirculation from irrigated fields. The concentration of dissolved solids in water from this well increased 690 ppm from 1965 to 1966. During the period 1957-66, the concentration of dissolved solids in water from the well has increased from 2,220 to 4,330 ppm.

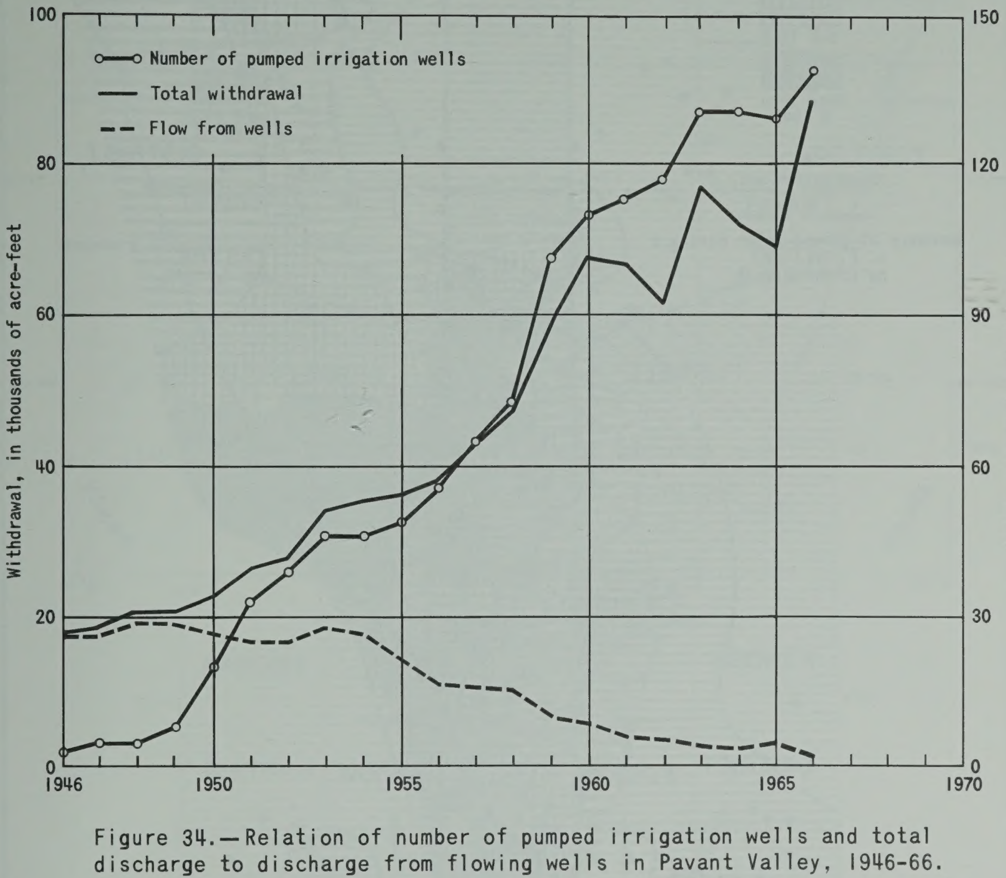

Figure 34.—Relation of number of pumped irrigation wells and total discharge to discharge from flowing wells in Pavant Valley, 1946-66.

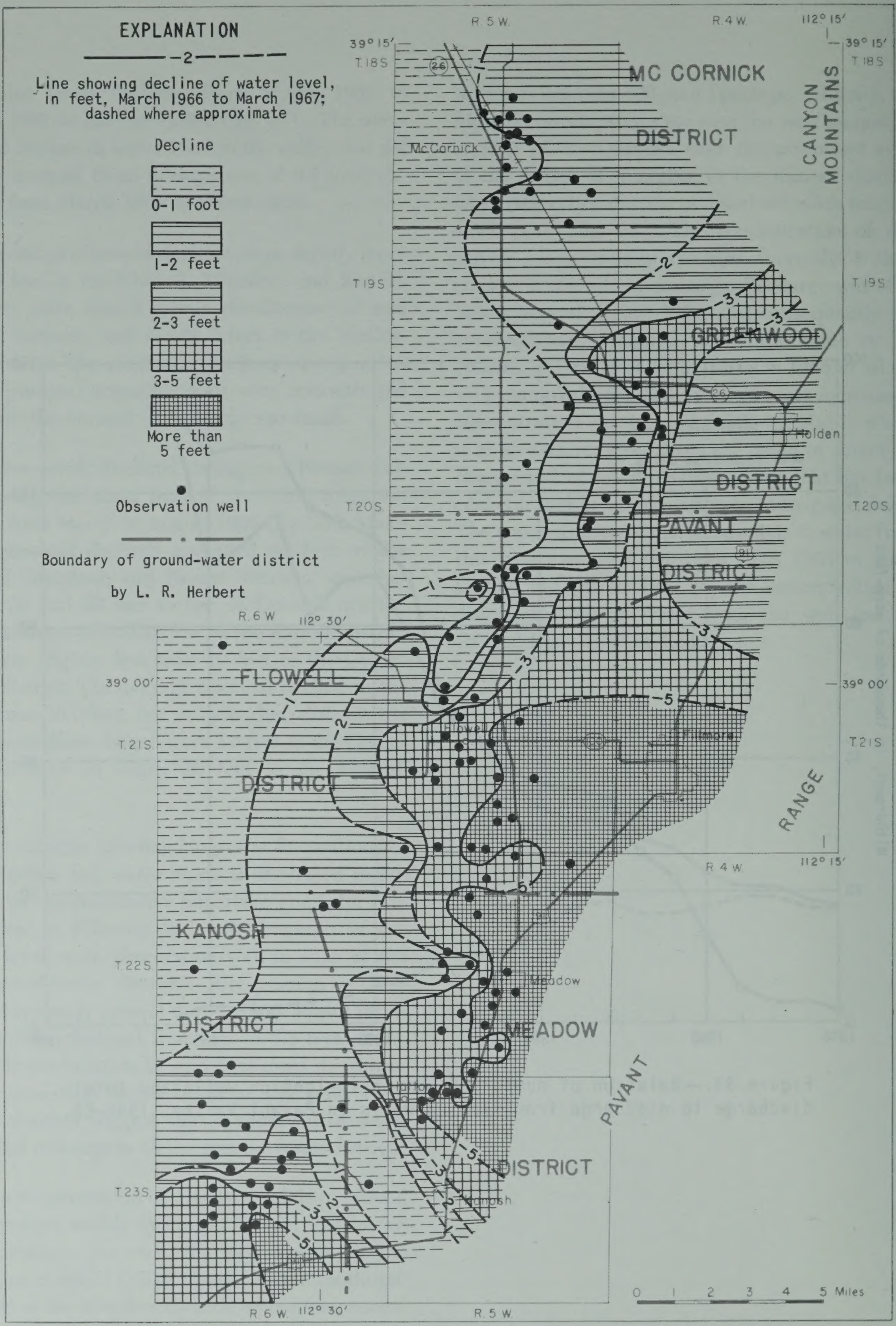

Figure 35.—Map of the Pavant Valley showing change of water levels from March 1966 to March 1967.

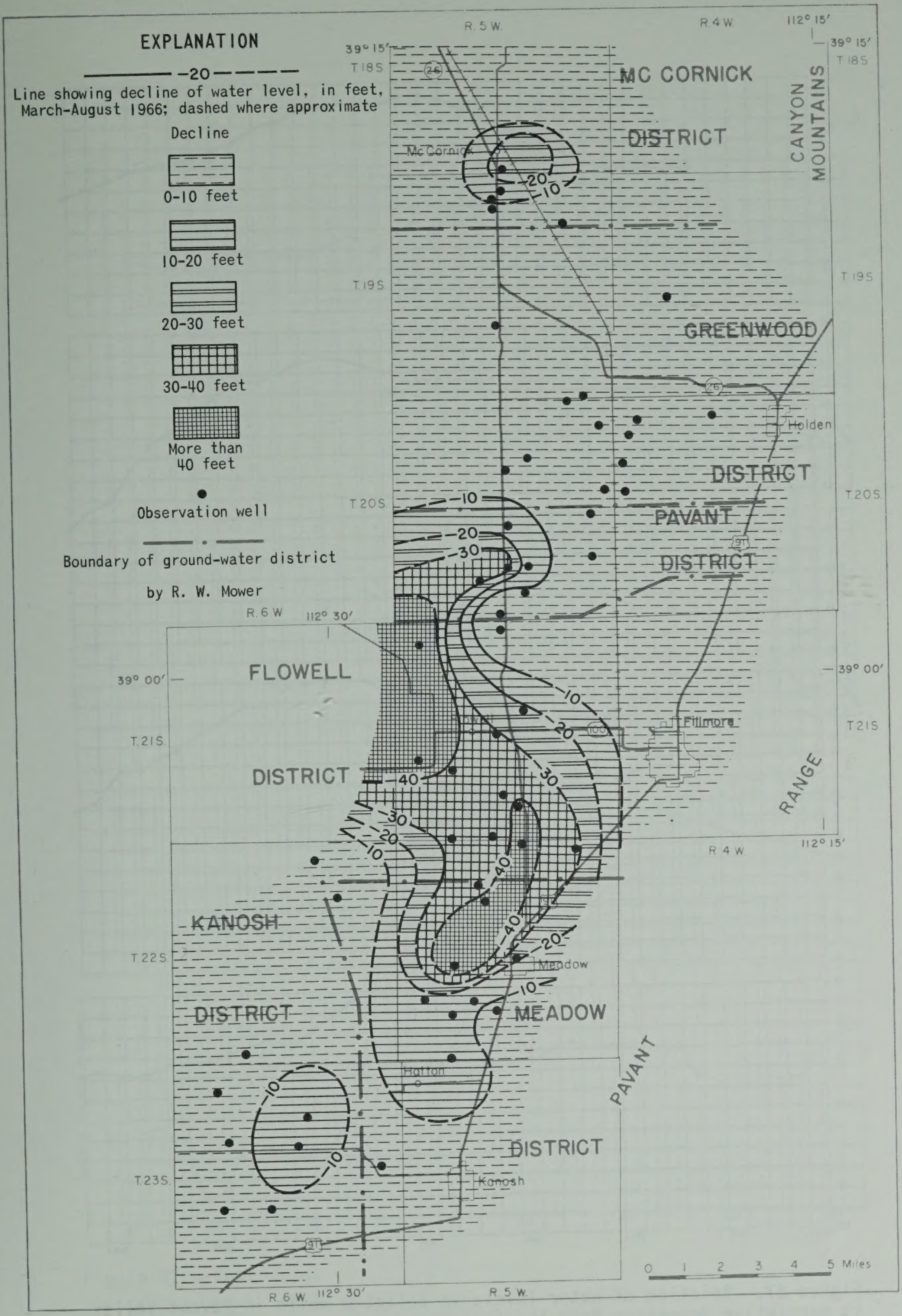

Figure 36.—Map of the Pavant Valley showing decline of water levels from March to August 1966.

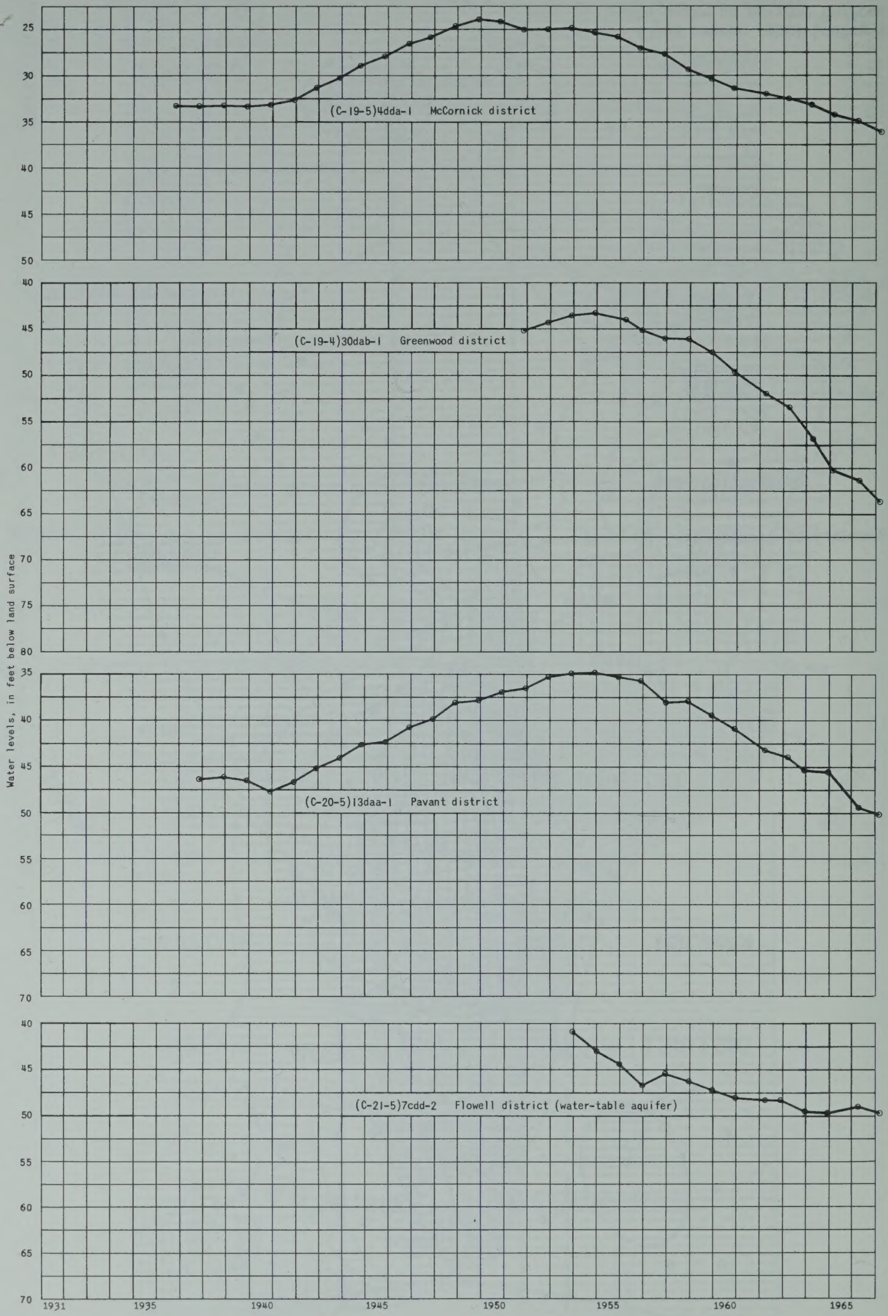

Figure 37.—Relation of water levels in selected wells in Pavant Valley to cumulative departure from the 1931-60 normal annual precipitation at Fillmore.

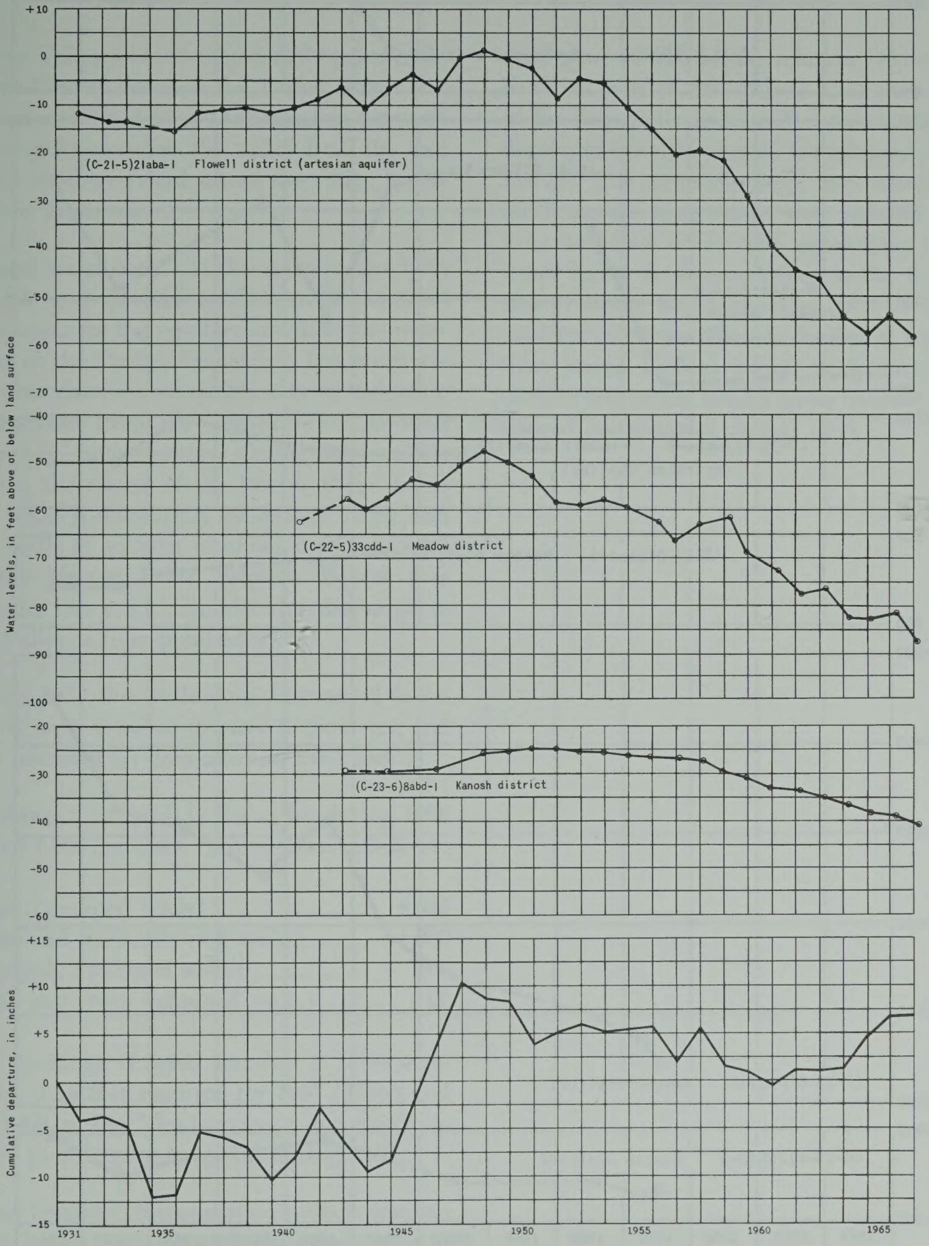

Figure 37.—Continued.

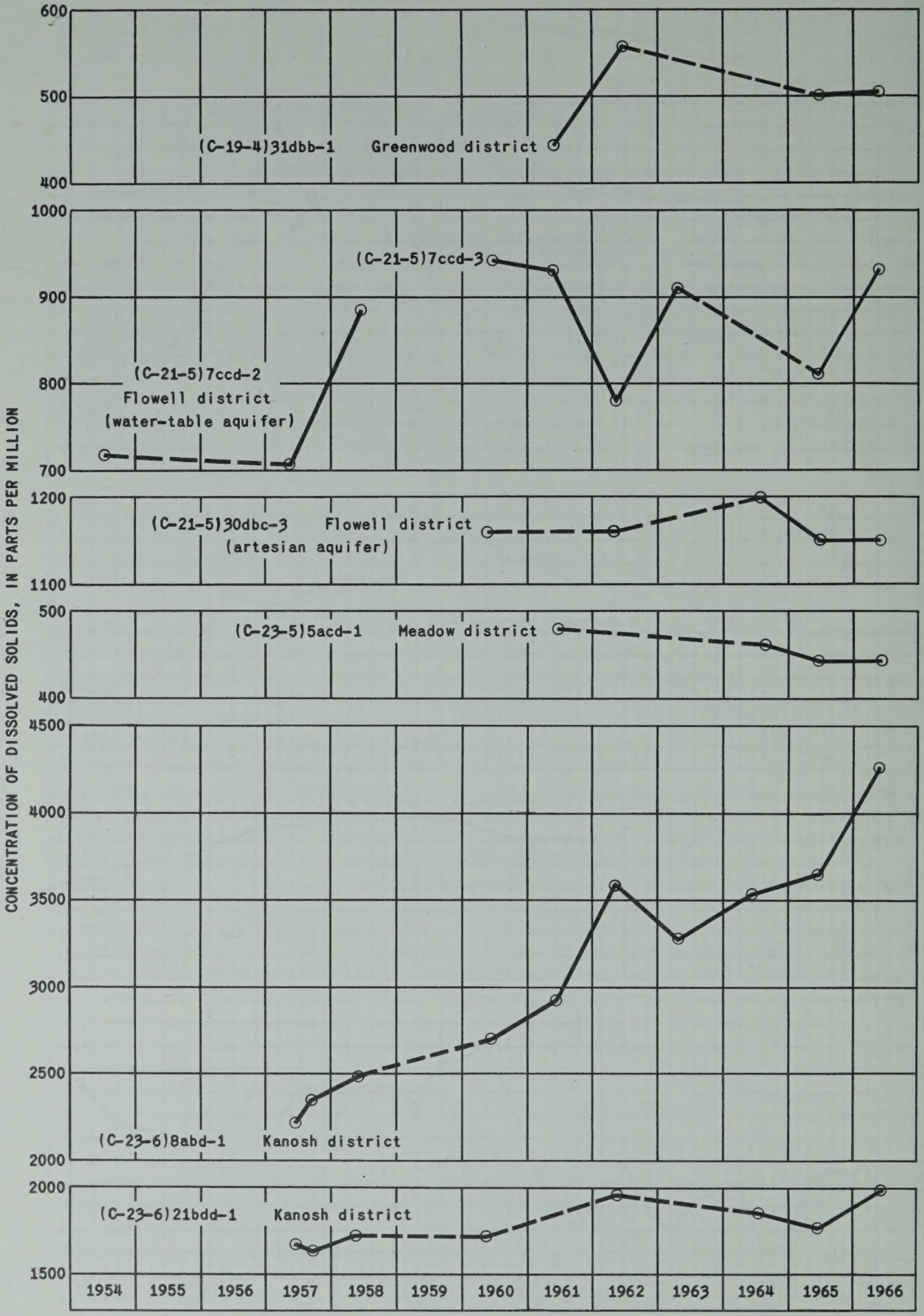

Figure 38.—Concentration of dissolved solids in water from six selected wells in Pavant Valley. (Concentrations calculated from determined constituents, except those for 1962 which were calculated from residue on evaporation at 180°C.

BEAVER VALLEY

by G. W. Sandberg

Beaver Valley includes about 200 square miles in Beaver County between the Tushar Mountains on the east and the Mineral Mountains on the west. The Beaver River enters the valley from the east and flows southwestward across the valley to the Minersville Reservoir.

Ground water occurs in the valley under both water-table and artesian conditions. The natural recharge areas for the aquifers are along the western base of the Tusher Mountains, but much recharge also comes from infiltration of irrigation water diverted from the Beaver River. Ground water moves southwestward through the valley, paralleling the course of the Beaver River. Some ground water is discharged by springs, seeps, and flowing wells in an area of about 6 square miles along the Beaver River between Beaver and Adamsville, but most ground-water discharge in Beaver Valley is from pumped wells.

During 1966, five wells were constructed in the valley. All were 6 inches or more in diameter, and all were intended for domestic and stock use.

Discharge from wells in the valley during 1966 was about 5,800 acre-feet, broken down as follows:

Irrigation (pumped wells)	4,640
Irrigation and stock (flowing wells)	1,000
Public supply (pumped wells)	100
Domestic and stock (pumped wells)	60

The discharge of 5,800 acre-feet is 1,400 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 75). The increase is due chiefly to increased pumping for irrigation during 1966.

Water levels in 10 observation wells in the valley were lower in March 1967 than they were in March 1966; they were slightly higher in two wells in the vicinity of Beaver (fig. 39).

Figure 40 shows the relation between water levels in well (C-29-7)21baa-1, annual discharge of the Beaver River near Beaver, and cumulative departure from the normal annual precipitation at Beaver. The generally high late summer water levels in the observation well indicate recharge from irrigated lands. The controlling factor for water levels in Beaver Valley is the flow of the Beaver River, which provides most of the water used for irrigation. The net decline of water levels from March 1966 to March 1967 reflects the decreased flow of the Beaver River because of below-normal precipitation during 1966.

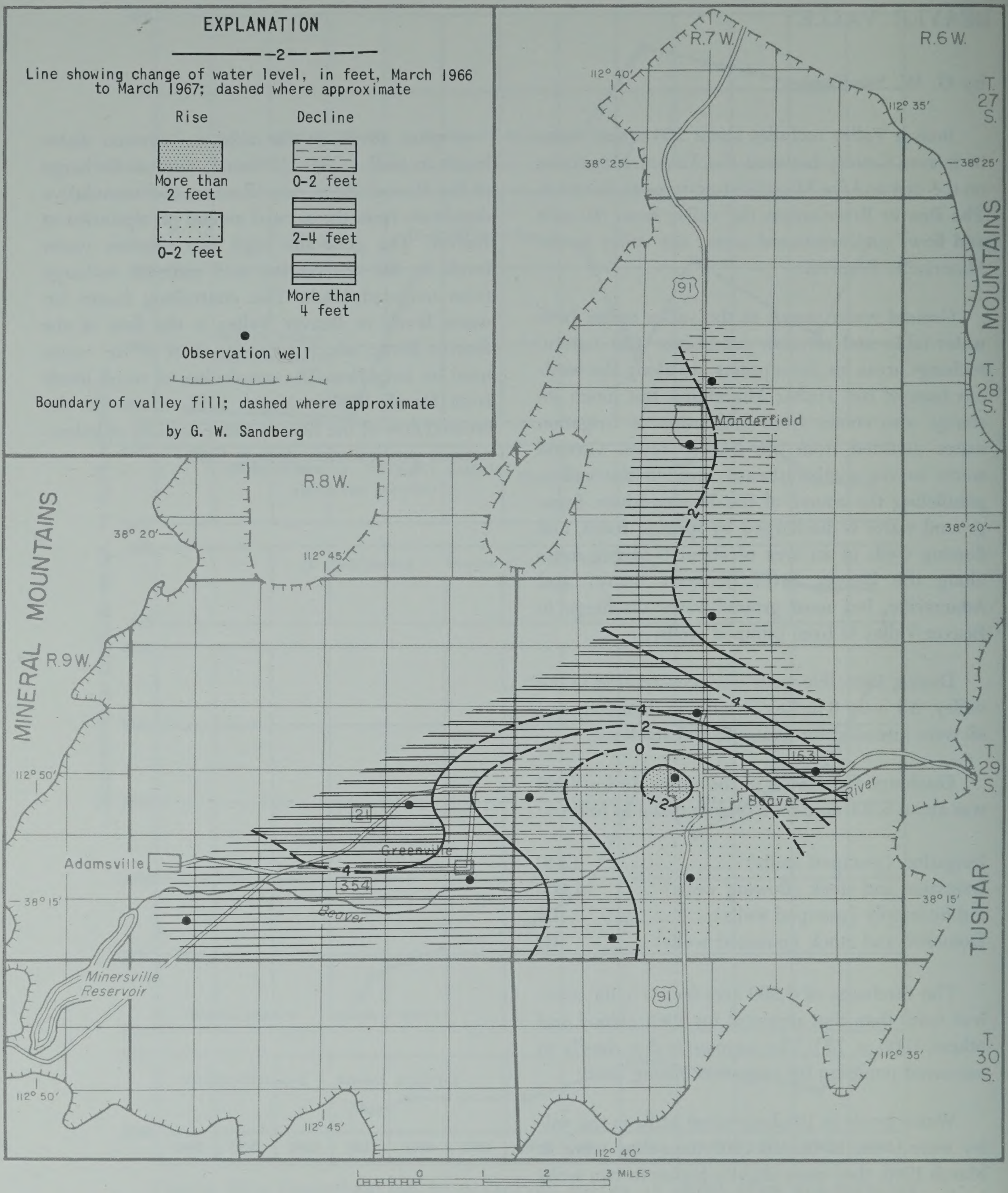

Figure 39.—Map of Beaver Valley showing change of water levels from March 1966 to March 1967.

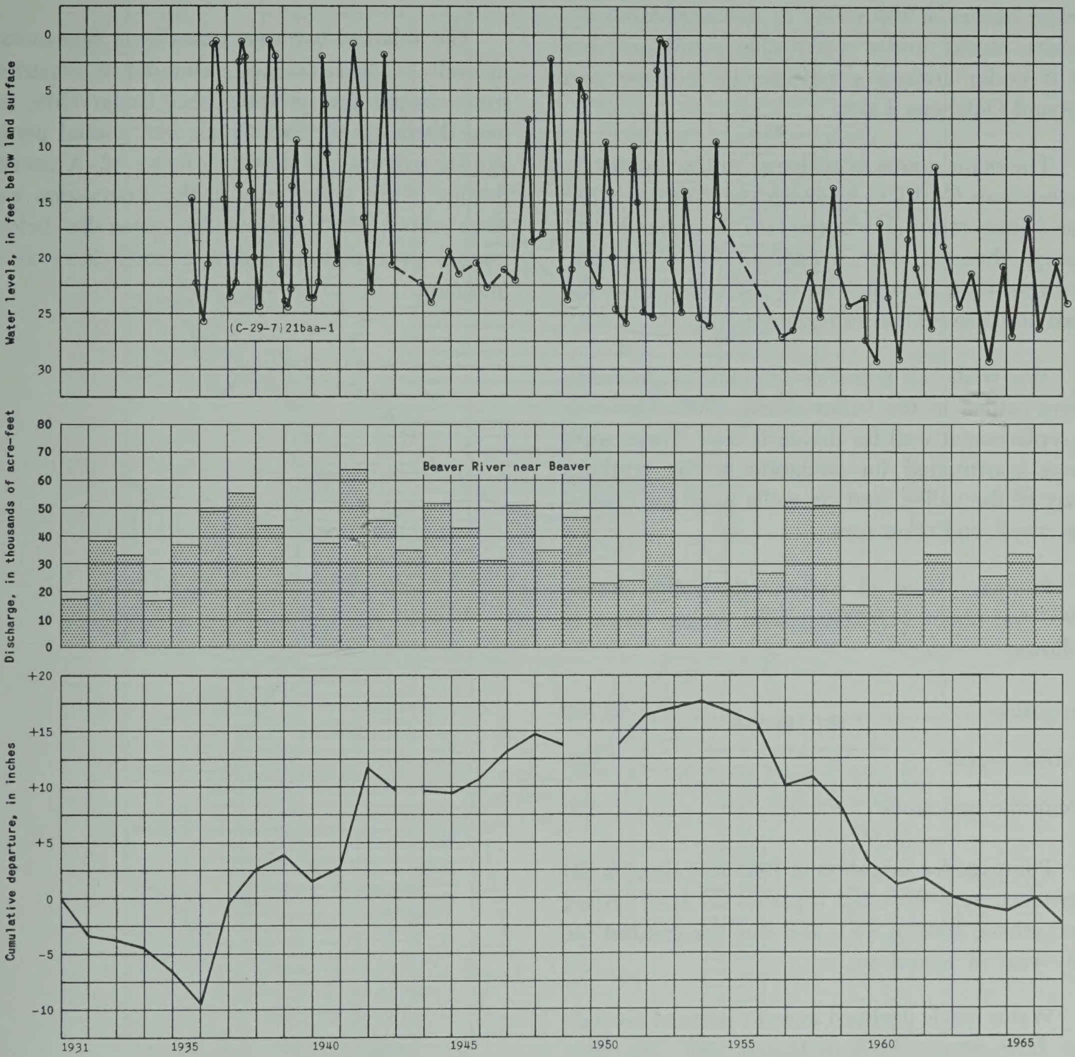

Figure 40.—Relation of water levels in well (C-29-7)21baa-1 and the annual discharge of the Beaver River near Beaver to the cumulative departure from the 1931-60 normal annual precipitation at Beaver.

CEDAR CITY VALLEY

by G. W. Sandberg

Cedar City Valley includes about 300 square miles in the eastern part of Iron County. Ground water occurs in the valley in unconsolidated deposits, mostly under water-table conditions; but it is under artesian conditions in the low area around Quichapa Lake.

The main source of recharge to the aquifers is water from Coal Creek, which seeps directly into the stream channel or seeps into the ground after being diverted for irrigation. Other smaller streams, most of which enter the valley from the east, are also sources of recharge.

Ten wells, all 6 inches or more in diameter, were drilled in the valley durng 1966. One was a replacement well for domestic use. Three wells were constructed for irrigation in the northern part of the valley, and six wells were for domestic, stock, and other uses.

Pumpage from all wells in the valley during 1966 was about 24,800 acre-feet, broken down as follows:

Irrigation	23,700
Public supply	900
Domestic and stock	150

Pumpage for irrigation in 1966 was about 8,100 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 78), and was the greatest for any year of record.

Water levels declined in most parts of the valley from March 1966 to March 1967 (fig. 41); declines were from about 1 foot to more than 3 feet. The decline of water levels is attributed to the below-normal precipitation which resulted in reduced recharge to the ground-water reservoir and increased pumping. Water levels rose in a small area in the vicinity of Kanarraville, near the south end of the valley.

The relation between water-level fluctuations in well (C-35-11)33aac-1, cumulative departure from normal precipitation near Cedar City, annual discharge of Coal Creek, and annual pumpage for irrigation is shown in figure 42. A general decline of the water level in the observation well since about 1950 reflects the generally below-normal precipitation and a general increase in pumping.

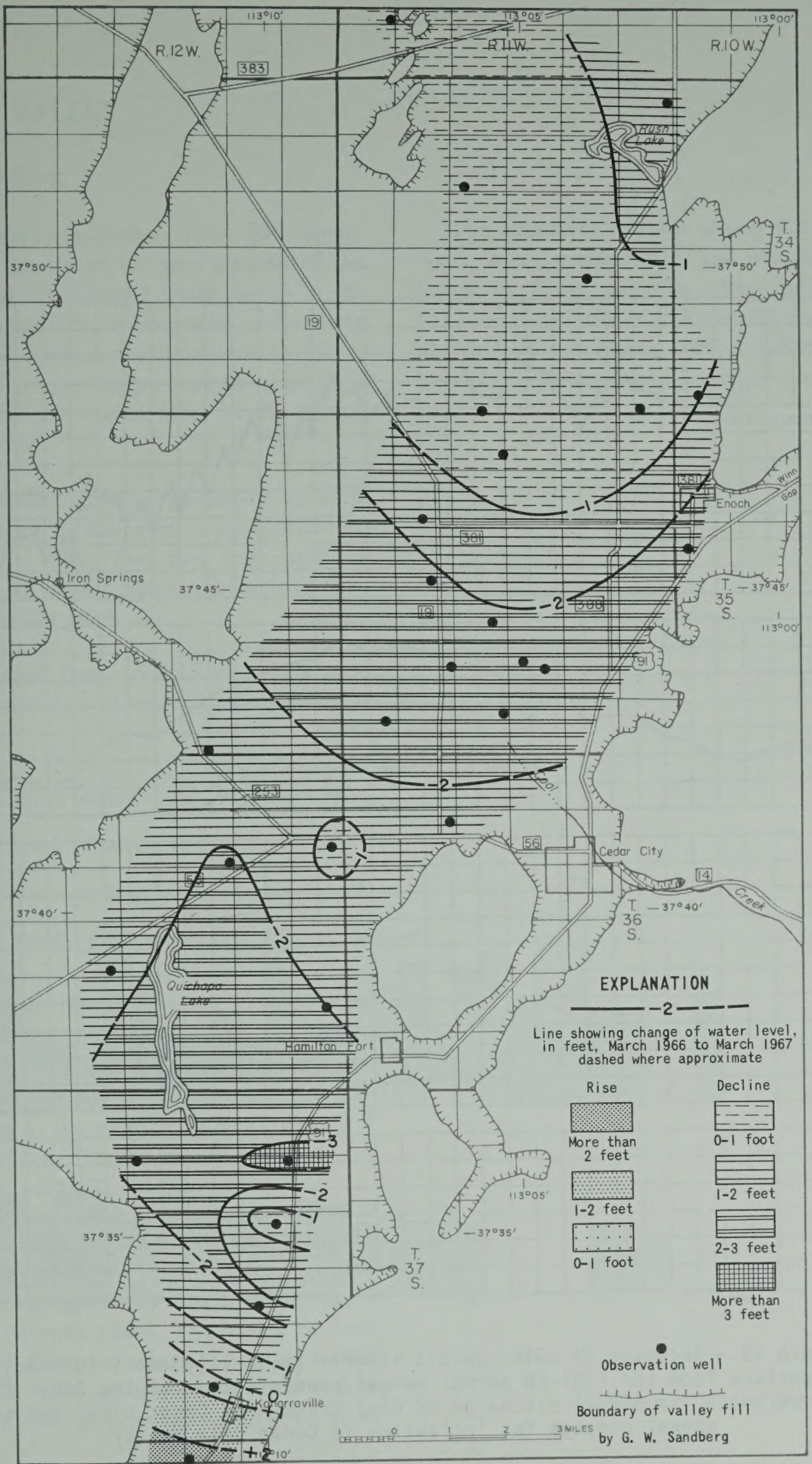

Figure 41.—Map of Cedar City Valley showing change of water levels from March 1966 to March 1967.

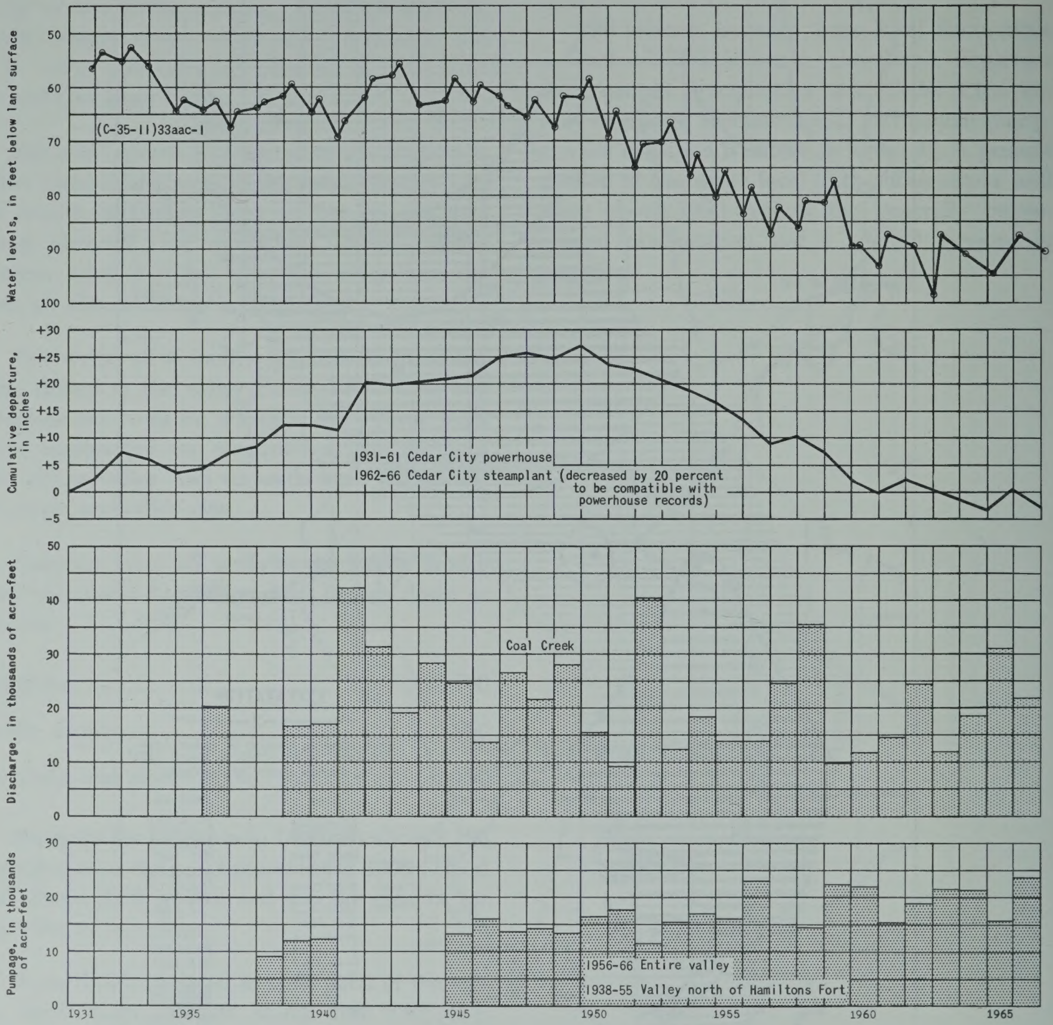

Figure 42.—Relation of water levels in well (C-35-11)33aac-1 to cumulative departure from the 1931-60 normal annual precipitation at the Cedar City powerhouse, to annual discharge of Coal Creek near Cedar City, and to annual pumpage for irrigation in Cedar City Valley.

PAROWAN VALLEY

by G. W. Sandberg

Parowan Valley includes about 150 square miles in Iron County at the western foot of the Markagunt Plateau. Ground water occurs in the valley in unconsolidated deposits under both water-table and artesian conditions, and the water is under sufficient artesian pressure to cause wells to flow in about 35 square miles in the central part of the valley.

Four new wells and two replacement wells, all 6 inches or more in diameter, were constructed in the valley in 1966. Two new wells and one replacement well were constructed for irrigation; the others were for stock use.

The discharge from wells during 1966 was about 19,600 acre-feet of water, broken down as follows:

Irrigation (pumped wells)	17,300
Irrigation and stock (flowing wells)	2,000
Public supply (pumped wells)	100
Domestic and stock (pumped wells)	150

The discharge of 19,600 acre-feet is 4,400 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 81) and is greater than the discharge reported for any year of record. The difference is due to the increase in the quantity of water pumped for irrigation during 1966.

Water levels in nearly all observation wells in the valley declined during 1966 (fig. 43). The decline in water levels was caused by the increased pumping at irrigation wells and by reduced recharge from Parowan Creek. The largest declines were north of Parowan, where the opportunities are greatest for recharge to the aquifers from flow in Parowan Creek or from water diverted from the creek.

The long-term relation among fluctuations of water levels, precipitation, and pumpage is illustrated in figure 44. The water level in well (C-34-8)5bca-1 declined about 3.5 feet between March 1966 and March 1967, a period of below-normal precipitation and increased pumping.

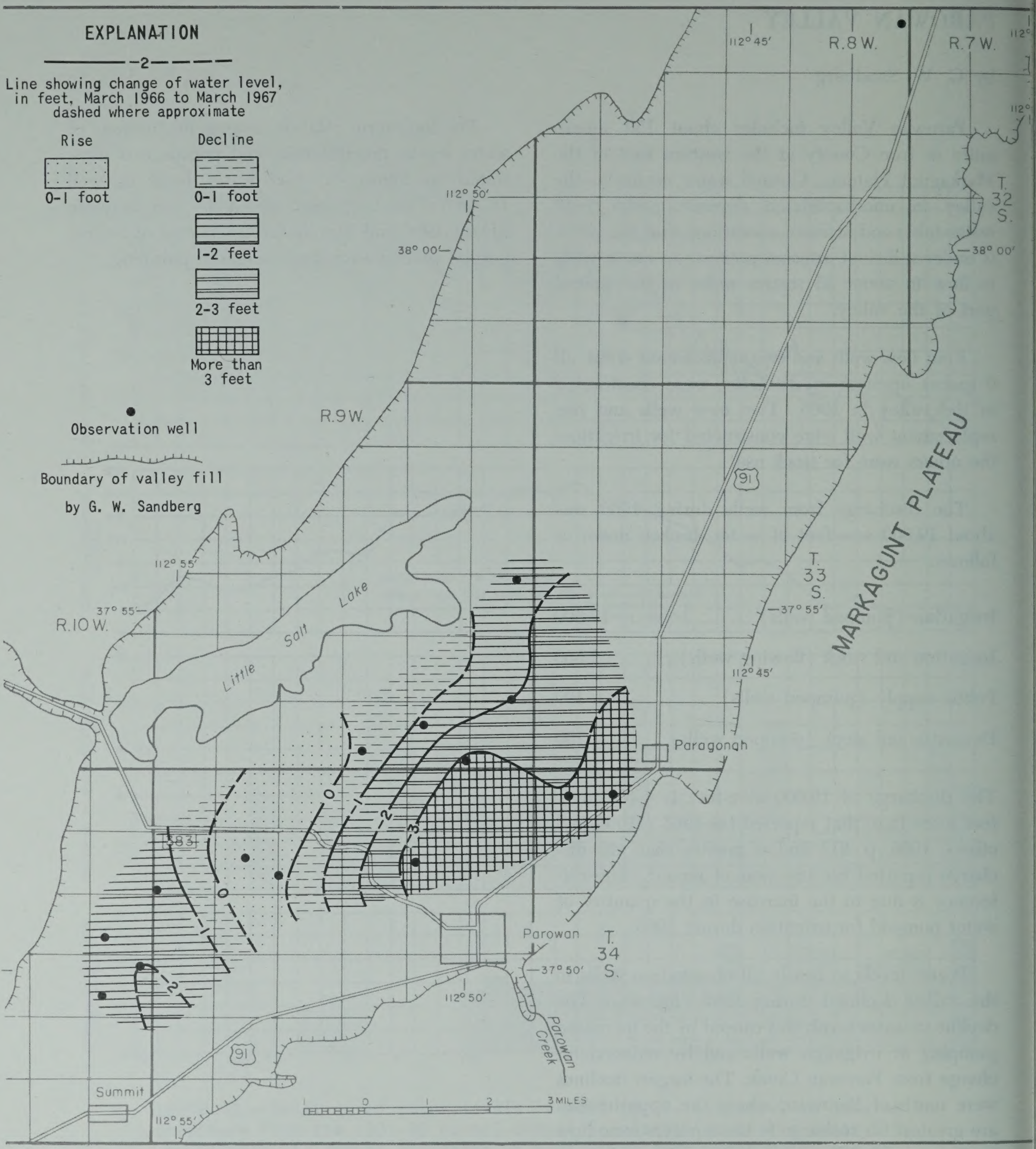

Figure 43.—Map of Parowan Valley showing change of water levels from March 1966 to March 1967.

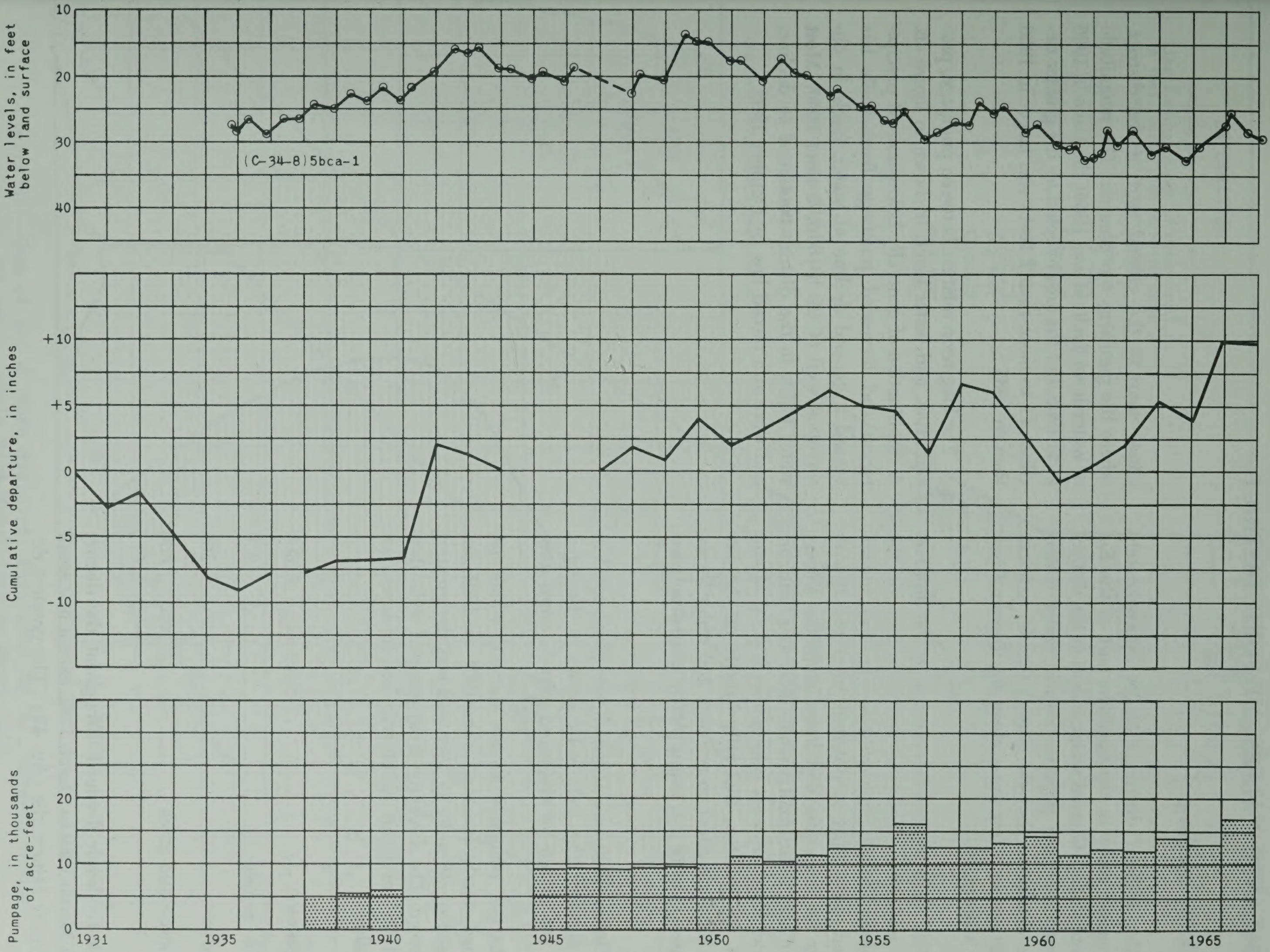

Figure 44.—Relation of water levels in well (C-34-8)5bca-1 to cumulative departure from the 1931-60 normal annual precipitation at Parowan and to pumpage for irrigation in Parowan Valley.

ESCALANTE VALLEY, MILFORD DISTRICT

by G. W. Sandberg

The Milford district includes approximately 300 square miles in the northern part of the Escalante Valley. Ground water occurs in the district in unconsolidated deposits, mostly under water-table conditions, but the water is under artesian conditions in a few areas along the Beaver River near Milford.

The main sources of recharge to the aquifers are: underflow from the southern part of the Escalante Valley (southwest of Thermo), unconsumed water that is diverted from the Beaver River for irrigation, and losses from the Beaver River and from small streams that flow into the district from the west side of the Mineral Mountains. Precipitation that falls directly on the district has little effect on recharge and water levels, because most of it is consumed by evapotranspiration.

During 1966, one new well was constructed in the district. The well is 14 inches in diameter, and was drilled for stock and miscellaneous uses.

Annual pumpage in the district, which remained nearly constant from 1961 to 1965, increased significantly in 1966 and was the greatest of record. The discharge from pumped wells during 1966 was about 50,200 acre-feet, broken down as follows:

Irrigation	49,300
Public supply	200
Industry	100
Domestic and stock	600

Water levels declined throughout the district from March 1966 to March 1967, except in a small area near Minersville (fig. 45). The greatest declines were in the central part of the district, where the pumping was greatest. The magnitude of water-level declines was about the same in 1966 as in 1965, but the area affected by the greater declines (1 to more than 2 feet) was larger in 1966 than in 1965.

The long-term relation between pumpage, precipitation, and water levels is shown in figure 46. A combination of generally below-normal precipitation and increased pumpage from wells has caused a general decline of water levels in observation well (C-29-10)6ddc-2 since 1950. Most water levels in the district continued to decline, and were at a record low by October 1966.

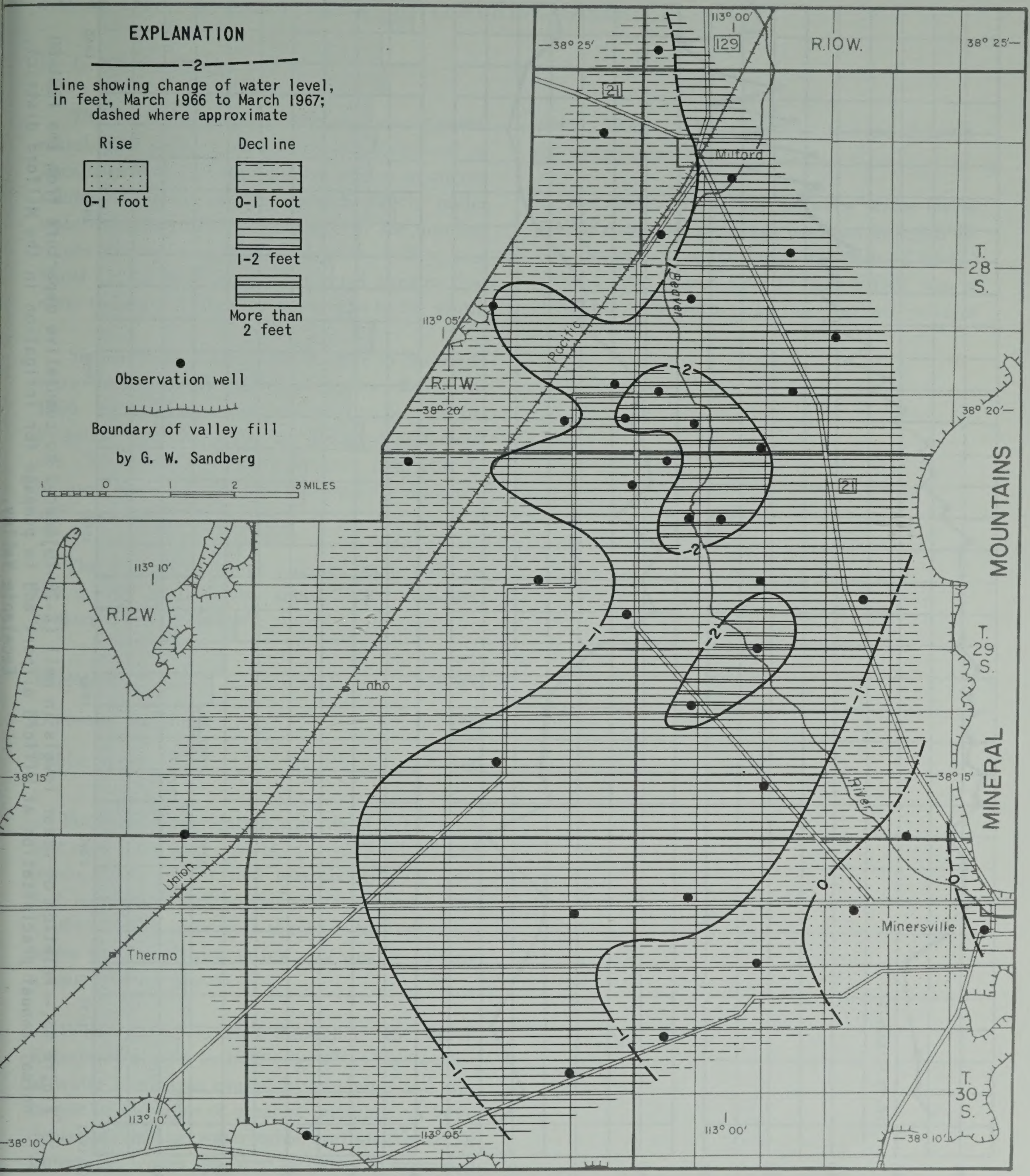

Figure 45.—Map of the Milford district, Escalante Valley, showing change of water levels from March 1966 to March 1967.

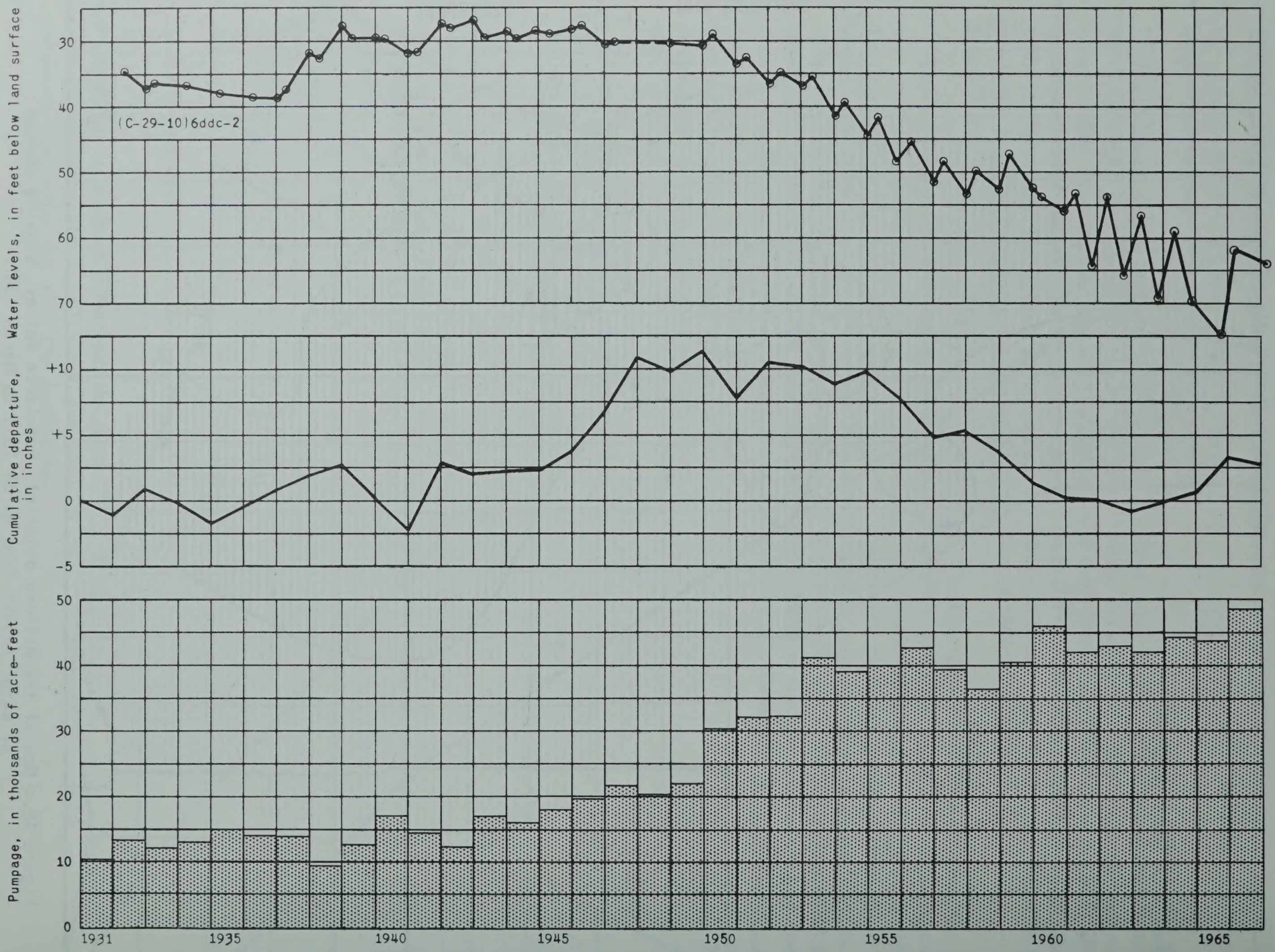

Figure 46.—Relation of water levels in well (C-29-10)6ddc-2 to cumulative departure from the 1931-60 normal annual precipitation at Milford airport and to pumpage for irrigation in the Milford district, Escalante Valley.

ESCALANTE VALLEY, BERYL-ENTERPRISE DISTRICT

by G. W. Sandberg

The Beryl-Enterprise district includes approximately 400 square miles in the southern end of Escalante Valley. Ground water occurs in unconsolidated deposits in the district, mostly under water-table conditions. Recharge to the aquifers comes mainly from Pinto, Meadow Valley, and Shoal Creeks, and from other small streams that enter the district from the mountains to the south.

Sixteen wells, all 6 inches or more in diameter, were drilled in the Beryl-Enterprise district in 1966. Six wells were new; one was to be used for irrigation and five were for domestic and stock use. Ten wells were replacements; five were to be used for irrigation and five were for domestic and stock use.

The amount of water pumped from wells in the district in 1966 was about 78,900 acre-feet, broken down as follows:

Irrigation	78,200
Domestic and stock	600
Public supply	100

Pumpage for irrigation was about 9,000 acre-feet more than that reported for 1965 (Hood and others, 1966, p. 87), and was about 7,300 acre-feet more than that of the previous record year (1964). The increased demand for irrigation water was largely due to hot, dry weather during a long growing season.

Water levels declined throughout the Beryl-Enterprise district in 1966 (fig. 47). The decline of water levels was caused by pumping and was largest in the areas of greatest pumping. A large depression in the water table north-northeast of Enterprise, which appeared in 1964 and expanded in 1965 (Arnow and others, 1965, p. 91; Hood and others, 1966, p. 87), continued to expand northeastward during 1966.

The long-term relation between water levels, precipitation, and pumpage is shown in figure 48. The decline of water levels in well (C-35-17) 25dcd-1 from March 1966 to March 1967 was at about the same rate as in the previous years of record.

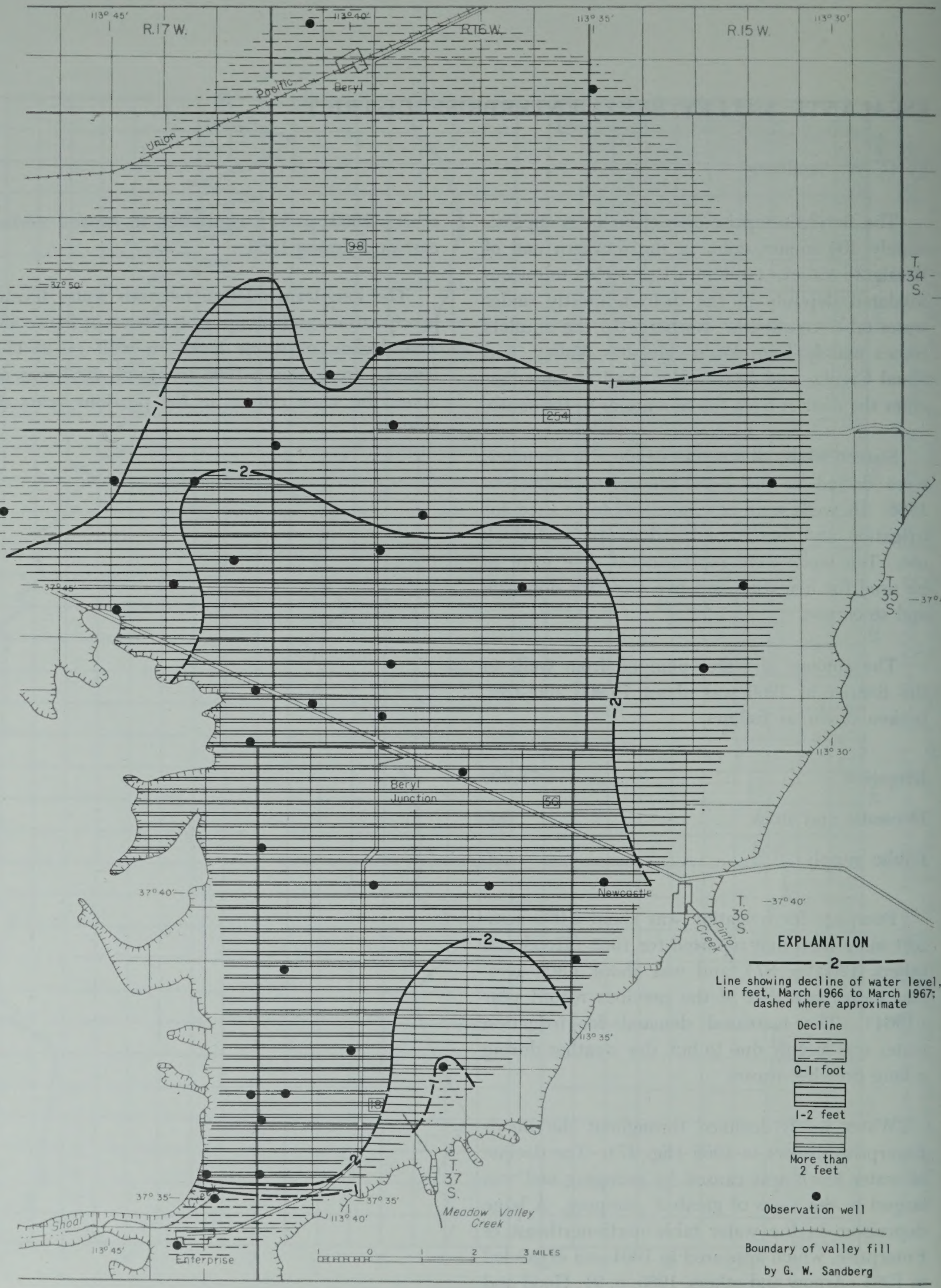

Figure 47.—Map of the Beryl-Enterprise district, Escalante Valley, showing change of water levels from March 1966 to March 1967.

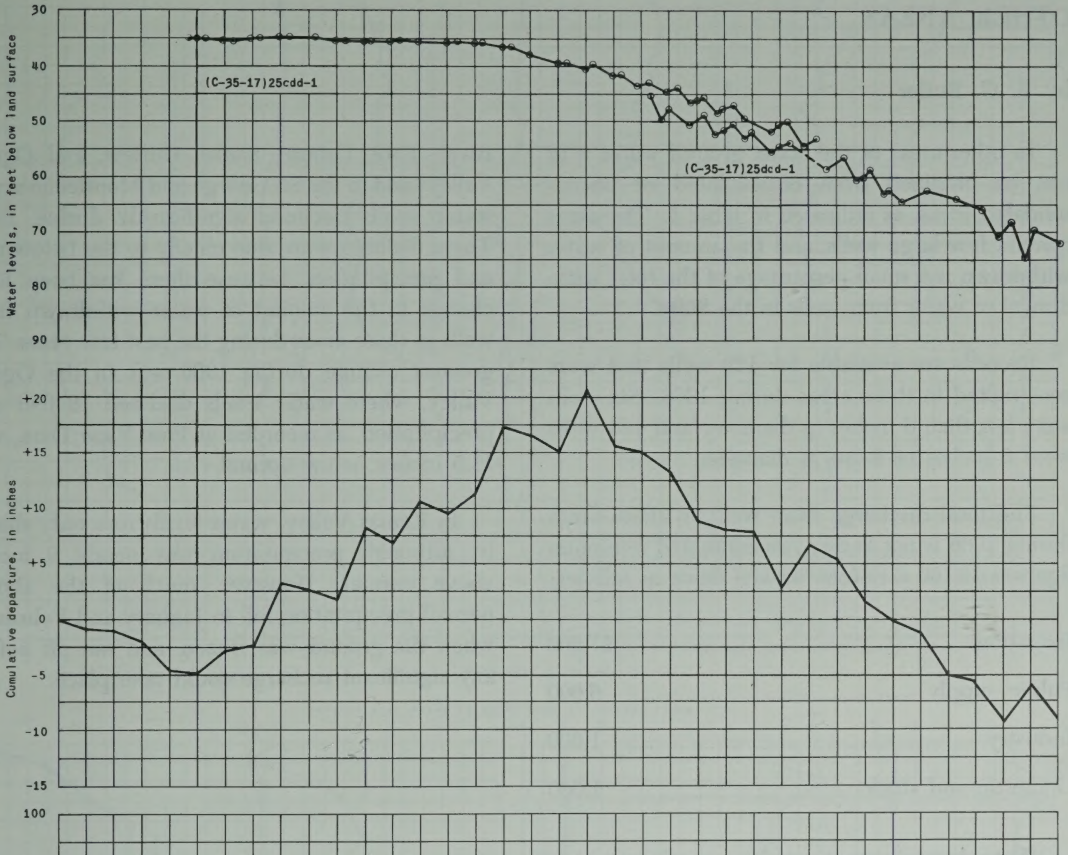

Figure 48.—Relation of water levels in wells (C-35-17)25cdd-1 and (C-35-17)25dcd-1 to cumulative departure from the 1931-60 normal annual precipitation at Modena and to pumpage for irrigation in the Beryl-Enterprise district, Escalante Valley.

OTHER AREAS

by R. G. Butler

In other areas of the State, ground water is or can be obtained from consolidated or unconsolidated rocks, as indicated in table 1. The areas contain few large wells, and the amount of water withdrawn is a small percentage of the total withdrawal of water from wells in the State.

Records are available for 129 wells that were constructed in these areas during 1966. Six wells were less than 6 inches in diameter and 123 wells were 6 inches or more in diameter.

The total discharge from wells in these areas during 1966 is not known; an estimated minimum figure is 36,100 acre-feet, broken down as follows:

Irrigation	27,500
Public supply	6,600
Industry	1,000
Domestic and stock	1,000

Water-level fluctuations in several areas are compared with long-term precipitation trends in figure 49. In the Blanding area, the Uinta Basin, and the upper Fremont Valley, water levels rose during 1966, although precipitation was below normal in each of these areas. The hydrographs for these areas indicate that a change in the precipitation graph is generally not reflected by a corresponding change in water levels until the following year.

In Morgan Valley and on the south flank of the Uinta Mountains, the water levels did not change significantly during 1966, although precipitation was below normal in both areas.

In the Dugway area, water levels declined because of below-normal precipitation and increased pumping during 1966. In Bear Lake, upper Bear River, Park, Grouse, Snake, Curlew, and Ogden Valleys and in the St. George and Monticello areas, water levels declined significantly during 1966. These declines were due chiefly to the below-normal precipitation, because there has been little change in the amount of water withdrawn from wells in these areas during the past few years. The greatest change during 1966 was in the Ogden Valley, where water levels declined 18 feet and precipitation, as recorded at Pine View Dam, was 11.5 inches below normal.

In Kamas Valley, water levels rose only slightly, although precipitation was nearly 9 inches above normal. However, much of the above-normal precipitation fell in January and February, when the ground was frozen, and ran off before any significant recharge could take place.

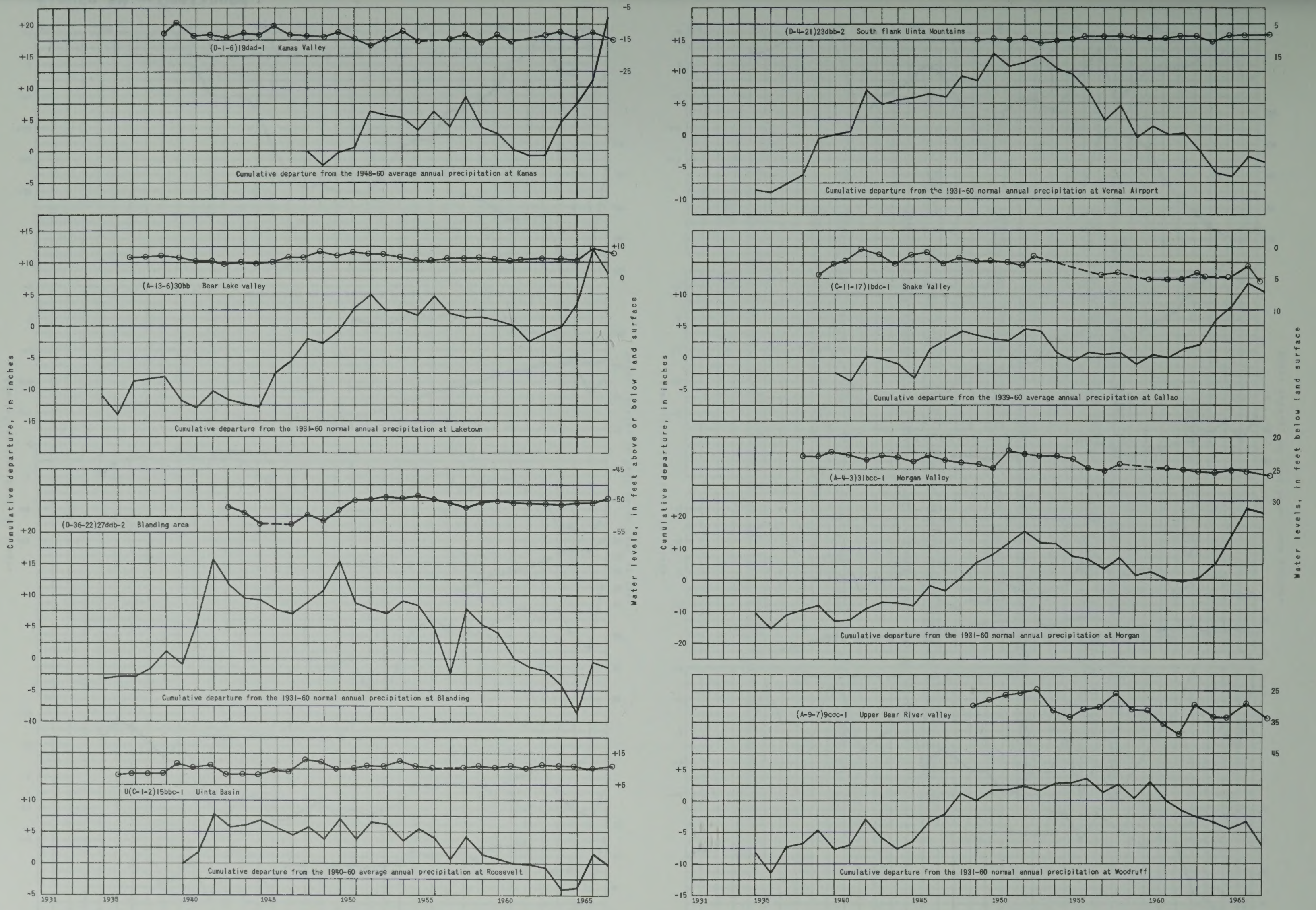

Figure 49.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.

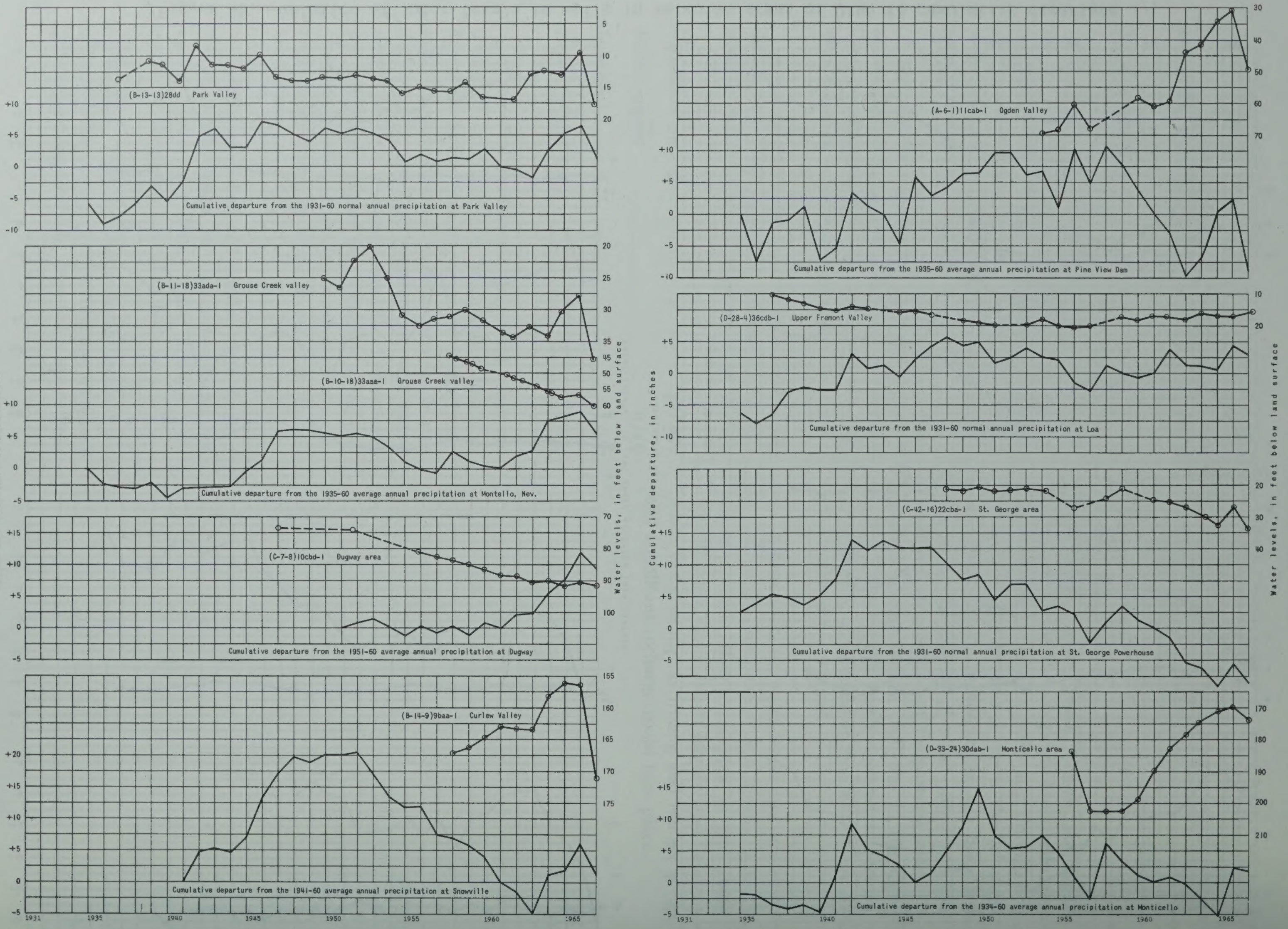

Figure 49.— Continued.

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